NAS 1.9/4:24/23
OLUME 24 / NUMBER 23
ECEMBER 8, 1986
CC. NOS. N86-31525 TO N86-32388

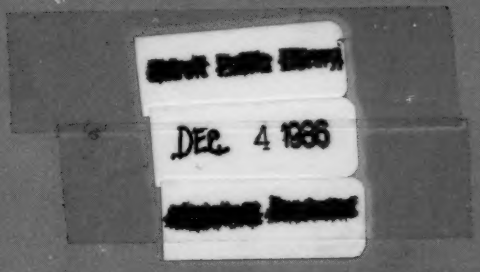
Red Seal

Technology and Science
Detroit Public Library

STAR

AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports



PRODUCED BY THE
SCIENTIFIC AND TECHNICAL
INFORMATION
BRANCH

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WHAT YOU CAN DO FOR *STAR*

All users of this abstract service are urged to forward reports to be considered for announcement in *STAR*. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those that you will transmit to NASA, DoD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Reprints of journal articles, book chapters, and conference papers are also welcome. These will be considered for announcement in *STAR's* companion journal, *International Aerospace Abstracts.*

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on public sale at the National Technical Information Service. Copyrighted publications will be announced but not distributed or sold.

PURCHASE OF *STAR*

The semimonthly issues are available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PUBLISHED BY:

UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION BRANCH
Scientific and Technical Aerospace Reports, Volume 24, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 22, 1988.

US ISSN 0036-8741

INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institutions, universities, and private firms
- Translations in report form
- NASA-owned patents and patent applications
- Dissertations and theses

Cumulative index volumes are published annually.

Journal, book, and conference literature, cover-to-cover journal translations, and certain foreign dissertations are announced in a companion journal, *International Aerospace Abstracts (IAA)*, available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

SUBJECT SCOPE

Subject scope of *STAR*, and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

OTHER NASA PUBLICATIONS

Other NASA publications and information services are described in the publication, *The NASA Scientific and Technical Information System ... and How to Use It*, available without charge from the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Detroit Public Library

EC 4 1986

Depository Document

HOW TO USE *STAR* SUBJECT CATEGORIES

STAR is categorized by 10 major subject divisions divided into 74 specific subject categories and one general category/division. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross-references. For example:

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

CROSS-REFERENCES

Individual *STAR* abstracts are not ordinarily cross-referenced, except for certain conference reports or book translations that have had separate abstracts written for their component papers or chapters. Citations and abstracts of the components follow immediately after those of the parent document. When the subject content of a component differs sufficiently from the general content of the parent, a cross-reference citation also is printed at the end of the category to which it normally would have been assigned if it were independent.

DOCUMENTS ON MICROFICHE

Documents on microfiche(1) are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

AVAILABILITIES

One or more sources from which a document announced in *STAR* is available to the public is given in each citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

(1) A microfiche is a transparent sheet of film, 105 by 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26:1 reduction).

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page vii.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, as indicated above, for those documents identified by a # symbol.)

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Adminstration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts*. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its' Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free. (See discussion of NASA patents and patent applications below.)

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address.

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.

NASA PATENTS AND PATENT APPLICATIONS

Patents and patent applications owned by NASA are announced in *STAR* under appropriate subject categories and are referenced in the *STAR* indexes. In the Report/Accession Number Index, patents are indexed by the NASA Case Number (which appears in lieu of the report number in other indexes), the U.S. Patent Number, the U.S. Patent Application Serial Number, and the U.S. Patent Class. Patent applications for which patents have not yet been issued are indexed by the NASA Case Number and the U.S. Patent Application Serial Number.

NASA *patent application specifications* are sold in paper copy by the National Technical Information Service at price code A02. Microfiche are sold at price code A01. The US-Patent-Appl-SN- number should be used in ordering either paper copy or microfiche from NTIS. Printed copies of *patents* (which are not microfiched) are available for purchase at $1.50 per copy from:

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, preferably by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the Patent and Trademark Office. The patents and patent applications announced in *STAR* are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

Assistant General Counsel for Patent Matters/Code GP
National Aeronautics and Space Administration
Washington, D.C. 20546

ELIGIBILITY AND REGISTRATION FOR NASA INFORMATION PRODUCTS AND SERVICES

A variety of services is available to organizations of the following types that have registered with NASA to receive specific services or products:

1. NASA offices, research centers, contractors, subcontractors, grantees, and consultants;
2. Other U.S. Government agencies and their contractors;
3. Libraries in the United States that have arrangements with NASA to maintain collections of NASA documents for public reference;
4. Other organizations in the United States having a need for NASA documents in work related to aeronautics and space research;
5. Organizations abroad that have established reciprocal document exchange arrangements with NASA.

Only the central service points or central points of document acquisition and control within qualified organizations are eligible to register for NASA products and services. Domestic organizations that may be eligible to receive various classes of NASA publications and services should address their requests for registration or for further information to:

NASA Scientific and Technical Information Facility
ATTN: Registration Activity
P.O. Box 8757
B.W.I. Airport, Maryland 21240

Organizations abroad should direct requests to the same address, but to the attention of: International Exchange Program.

AVAILABILITY OF *STAR* ABSTRACTS ON MICROFICHE

Microfiche of the abstract sections of this issue and other issues of *STAR* are available on annual subscription from NTIS, Attn: Subscriptions, 5285 Port Royal Road, Springfield, Virginia 22161. Annual subscription rates are $70.00 North America; $140.00 foreign. Abstract sections for previous years retroactive to 1964 are available at the current rates. Microfiche for individual *STAR* issue abstract sections are not available.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC: NASA and NASA-sponsored documents and a large number of aerospace publications are available to the public for reference purposes at the library maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

EUROPEAN: An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols # and * from ESA - Information Retrieval Service European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris CEDEX 15, France.

FEDERAL DEPOSITORY LIBRARY PROGRAM

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 50 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 50 regional depositories. A list of the regional GPO libraries, arranged alphabetically by state, appears on the inside back cover. These libraries are *not* sales outlets. A local library can contact a Regional Depository to help locate specific reports, or direct contact may be made by an individual.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics and Astronautics
Technical Information Service
555 West 57th Street, 12th Floor
New York, New York 10019

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International, Ltd.
1495 Chain Bridge Road
McLean, Virginia 22101

ESDU International, Ltd.
251-259 Regent Street
London, W1R 7AD, England

Fachinformationszentrum Energie, Physik, Mathematik GMBH
7514 Eggenstein Leopoldshafen
Federal Republic of Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information Facility
P.O. Box 8757
B.W.I. Airport, Maryland 21240

National Aeronautics and Space Administration
Scientific and Technical Information Branch (NTT-1)
Washington, D.C. 20546

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library
National Center - MS 950
12201 Sunrise Valley Drive
Reston, Virginia 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, Arizona 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, Colorado 80225

NTIS PRICE SCHEDULES

(Effective October 1, 1985)

Schedule A
STANDARD PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	PAGE RANGE	NORTH AMERICAN PRICE	FOREIGN PRICE
A01	Microfiche	$ 5.95	$11.90
A02-A03	001-050	9.95	19.90
A04-A05	051-100	11.95	23.90
A06-A09	101-200	16.95	33.90
A10-A13	201-300	22.95	45.90
A14-A17	301-400	28.95	57.90
A18-A21	401-500	34.95	69.90
A22-A25	501-600	40.95	81.90
A99	601-up	*	*
NO1		40.00	70.00
NO2		40.00	70.00

Schedule E
EXCEPTION PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	NORTH AMERICAN PRICE	FOREIGN PRICE
E01	$ 7.50	15.00
E02	10.00	20.00
E03	11.00	22.00
E04	13.50	27.00
E05	15.50	31.00
E06	18.00	36.00
E07	20.50	41.00
E08	23.00	46.00
E09	25.50	51.00
E10	28.00	56.00
E11	30.50	61.00
E12	33.00	66.00
E13	35.50	71.00
E14	38.50	77.00
E15	42.00	84.00
E16	46.00	92.00
E17	50.00	100.00
E18	54.00	108.00
E19	60.00	120.00
E20	70.00	140.00
E99	*	*

*Contact NTIS for price quote.

IMPORTANT NOTICE

NTIS Shipping and Handling Charges (effective June 1, 1985)
U.S., Canada, Mexico — ADD $3.00 per TOTAL ORDER
All Other Countries — ADD $4.00 per TOTAL ORDER

Exceptions — Does NOT apply to:
ORDERS REQUESTING NTIS RUSH HANDLING
ORDERS FOR SUBSCRIPTION OR STANDING ORDER PRODUCTS *ONLY*

NOTE: Each additional delivery address on an order requires a separate shipping and handling charge.

VOLUME 24 NUMBER 23 / DECEMBER 8, 1986

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 3549

02 AERODYNAMICS 3549
Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.
For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 3552
Includes passenger and cargo air transport operations; and aircraft accidents.
For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 3553
Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.
For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 3554
Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

06 AIRCRAFT INSTRUMENTATION 3557
Includes cockpit and cabin display devices; and flight instruments.
For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 3557
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.
For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 3559
Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 3560
Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.
For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 3561
For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS 3562
Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 3563
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.
For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 3564
Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 3564
Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.
For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING 3564
Includes telemetry; space communications networks; astronavigation; and radio blackout.
For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 3565
Includes spacecraft thermal and environmental control; and attitude control.
For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

19 SPACECRAFT INSTRUMENTATION 3567
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 3567
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 3570
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 3570
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 3573
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS 3576
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 3581
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 3584
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) 3585
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 3586
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 3590
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuity.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 3595
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 3600
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 3604
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 3605
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 3609
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 3609
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 3613
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 3619
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION 3622
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 3623
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 3626
Includes weather forecasting and modification.

48 OCEANOGRAPHY 3633
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 3634
Includes genetics.

52 AEROSPACE MEDICINE 3635
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 3636
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 3637
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY 3638
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) 3639

60 COMPUTER OPERATIONS AND HARDWARE 3639
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE 3640
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 3646
Includes computer networks.

63 CYBERNETICS 3647
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS 3649
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 3653
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 3655
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 3655
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) 3656
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS 3657
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 3657
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 3659
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 3660
Includes light phenomena.

75 PLASMA PHYSICS 3662
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 3664
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 3667
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) **N.A.**
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT **3668**
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE **3670**
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS **N.A.**
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE **3671**
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION **3671**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **3671**

89 ASTRONOMY **3676**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **3677**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **3679**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **N.A.**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **N.A.**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

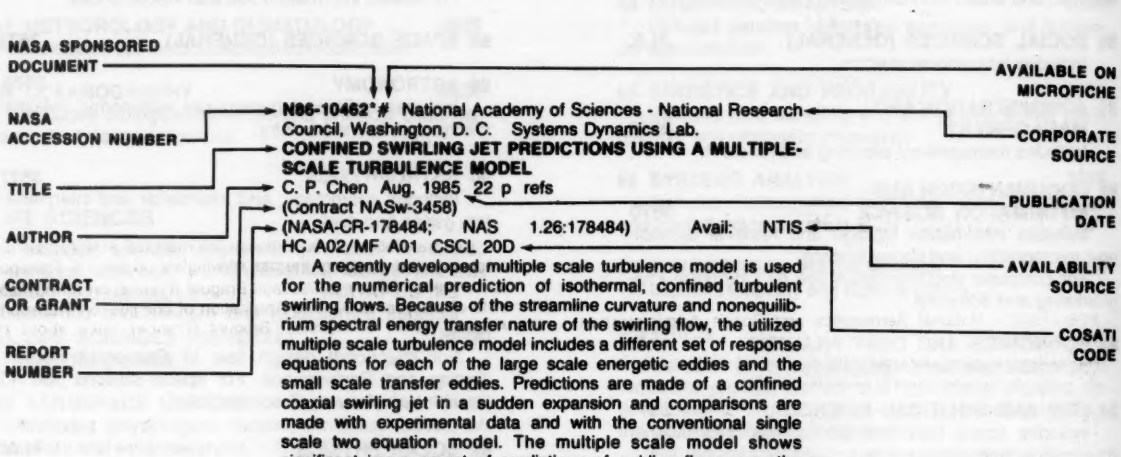
GENERAL

99 GENERAL **N.A.**

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX **I-1**
PERSONAL AUTHOR INDEX **I-55**
CORPORATE SOURCE INDEX **I-61**
CONTRACT NUMBER INDEX **I-73**
REPORT/ACCESSION NUMBER INDEX **I-75**

TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 23 / DECEMBER 8, 1986

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-31525* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 202)
1986 130 p
(NASA-SP-7037(202); NAS 1.21:7037(202)) Avail: NTIS HC A07 CSCL 01A

This bibliography lists 447 reports, articles and other documents introduced into the NASA scientific and technical information system in June 1986. Author

N86-31526* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 203)
1986 129 p
(NASA-SP-7037(203); NAS 1.21:7037(203)) Avail: NTIS HC A07 CSCL 01A

This bibliography lists 449 reports, articles and other documents introduced into the NASA scientific and technical information system in July 1986. Author

N86-31527*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELLIPTIC GENERATION OF COMPOSITE THREE-DIMENSIONAL GRIDS ABOUT REALISTIC AIRCRAFT
Reese L. Sorenson Mar. 1986 22 p
(NASA-TM-88240; A-86165; NAS 1.15:88240) Avail: NTIS HC A02/MF A01 CSCL 01B

An elliptic method for generating composite grids about realistic aircraft is presented. A body-conforming grid is first generated about the entire aircraft by the solution of Poisson's differential equation. This grid has relatively coarse spacing, and it covers the entire physical domain. At boundary surfaces, cell size is controlled and cell skewness is nearly eliminated by inhomogeneous terms, which are found automatically by the program. Certain regions of the grid in which high gradients are expected, and which map into rectangular solids in the computational domain, are then designated for zonal refinement. Spacing in the zonal grids is reduced by adding points with a simple, algebraic scheme. Details of the grid generation method are presented along with results of the present application, a wing-body configuration based on the F-16 fighter aircraft. Author

N86-31528# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNATIONAL AVIATION (SELECTED ARTICLES)
Daxi Yang and Lingyen Zhong 4 Apr. 1986 14 p Transl. into ENGLISH from Guoji Hangkong (China), no. 5(267), May 1985 p 2-3; 26; 52
(AD-A166298; FTD-ID(RS)T-0844-85) Avail: NTIS HC A02/MF A01 CSCL 01/3

This translation of the Chinese International Aviation contains articles on the following: the use of winglets on the T-5 Transport; and a talk by Payley of Dassault Breguet (France) on Aerodynamicists of the year 2000. The Application of Winglets on Transport-5 Aircraft; Payley of Dassault Breguet (France) talks about the Aerodynamicists of the Year 2000. GRA

N86-31529# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYTICAL METHODOLOGY FOR PREDICTING REPAIR TIME DISTRIBUTIONS OF ADVANCED TECHNOLOGY AIRCRAFT M.S. Thesis
Dennis C. Dietz Dec. 1985 226 p
(AD-A167149; AFIT/GOR/OS/85D-3) Avail: NTIS HC A11/MF A01 CSCL 15/5

Classical probability theory is applied to analytically combine known or hypothesized subsystem reliability distribution for repair time of an advanced technology aircraft. While repair time of a weapon system is determined by a complex interaction of many factors, the relatively high reliability predicted for advanced technology aircraft justifies several simplifying assumptions which permit an analytical approach. The applicability of the analytical method is examined by comparing analytical repair time distributions with distributions produced by Monte Carlo simulation. Using the Advanced Tactical Fighter as an example, comparisons are performed over a wide range of relevant factors. Overall aircraft reliability emerges as the single critical factor determining the applicability of the method. A simple model is presented for translating the aircraft repair time distribution into measures of aircraft operational effectiveness (availability and sortie generation rate) under a specified concept of operations. The translation model demonstrates how the analytical method for forming a repair time distribution could be used to heuristically determine how to best allocate a reliability and maintainability budget to various subsystems as an aircraft design is developed. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-31530*# Technische Hochschule, Aachen (West Germany). Aerodynamisches Inst.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF VORTEX BREAKDOWN Final Technical Report, 1 Jun. 1985 - 31 May 1986
Egon Krause 1986 47 p
(Grant NAGw-816)
(NASA-CR-176853; NAS 1.26:176853) Avail: NTIS HC A03/MF A01 CSCL 01A

The slender-vortex approximation was analyzed for incompressible and compressible flow. First the equations of motion were reduced in an order of magnitude analysis. Then compatibility conditions were formulated for the inflow conditions. Thereafter finite-difference-solutions were constructed for incompressible and compressible flow. Finally it was shown that these solutions can be used to describe the flow in slender vortices. The analysis of the breakdown process must, however, be excluded, since its upstream influence cannot be predicted with the slender vortex approximation. The investigaton of this problem is left for future work. Author

N86-31531*# Wichita State Univ., Kans.
WEIGHT ESTIMATION TECHNIQUES FOR COMPOSITE AIRPLANES IN GENERAL AVIATION INDUSTRY
T. Paramasivam, Walter J. Horn, and James Ritter Sep. 1986 89 p
(Grant NAG1-452)
(NASA-CR-178163; NAS 1.26:178163; AR-86-1) Avail: NTIS HC A05/MF A01 CSCL 01C

Currently available weight estimation methods for general aviation airplanes were investigated. New equations with explicit material properties were developed for the weight estimation of aircraft components such as wing, fuselage and empennage. Regression analysis was applied to the basic equations for a data base of twelve airplanes to determine the coefficients. The resulting equations can be used to predict the component weights of either metallic or composite airplanes. Author

N86-31532*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 1/8-SCALE X-29A AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESLIP
Raymond D. Whipple and Jonathan L. Ricket (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) Sep. 1986 289 p
(NASA-TM-87722; L-15919; NAS 1.15:87722) Avail: NTIS HC A13/MF A01 CSCL 01A

A 1/8-scale model of the X-29A airplane was tested in the Ames 12-Foot Pressure Wind Tunnel at a Mach number of 0.20 and Reynolds numbers of 0.13 x 10 to the 6th power to 2.00 x 10 to the 6th power based on a fuselage forebody depth of 0.4 ft, For the test series presented herein, the angle of attack ranged from 40 deg. to 90 deg. and the angle of sideslip ranged from -10 deg. to 30 deg. for the erect attitude. Tests with the model inverted covered angles of attack from -40 deg. to -90 deg. and angles of sideslip from -30 deg. to 10 deg. Data were obtained for the basic design and for several forebody strakes. An alternate forebody design was also tested. The results provided information for selection of forebody strakes for compensation of Reynolds number effect on the 1/25-scale free-spinning model tested in the Langley Spin Tunnel. Author

N86-31533*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
USER'S MANUAL FOR XTRAN2L (VERSION 1.2): A PROGRAM FOR SOLVING THE GENERAL-FREQUENCY UNSTEADY TRANSONIC SMALL-DISTURBANCE EQUATION
David A. Seidel and John T. Batina Jul. 1986 88 p
(NASA-TM-87737; NAS 1.15:87737) Avail: NTIS HC A05/MF A01 CSCL 01A

The development, use and operation of the XTRAN2L program that solves the two dimensional unsteady transonic small disturbance potential equation are described. The XTRAN2L program is used to calculate steady and unsteady transonic flow fields about airfoils and is capable of performing self contained transonic flutter calculations. Operation of the XTRAN2L code is described, and tables defining all input variables, including default values, are presented. Sample cases that use various program options are shown to illustrate operation of XTRAN2L. Computer listings containing input and selected output are included as an aid to the user. Author

N86-31534*# Old Dominion Univ., Norfolk, Va.
EFFECT OF ASPECT RATIO ON SIDEWALL BOUNDARY-LAYER INFLUENCE IN TWO-DIMENSIONAL AIRFOIL TESTING
A. V. Murthy Washington NASA Sep. 1986 31 p
(Grant NAG1-334)
(NASA-CR-4008; NAS 1.26:4008) Avail: NTIS HC A03/MF A01 CSCL 01A

The effect of sidewall boundary layers in airfoil testing in two-dimensional wind tunnels is investigated. The non-linear crossflow velocity variation induced because of the changes in the sidewall boundary-layer thickness is represented by the flow between a wavy wall and a straight wall. Using this flow model, a correction for the sidewall boundary-layer effects is derived in terms of the undisturbed sidewall boundary-layer properties, the test Mach number and the airfoil aspect ratio. Application of the proposed correction to available experimental data showed good correlation for the shock location and pressure distribution on airfoils. Author

N86-31535*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ATRAN3S: AN UNSTEADY TRANSONIC CODE FOR CLEAN WINGS
Guru P. Guruswamy (Informatics General Corp., Palo Alto, Calif.), Peter M. Goorjian, and Fergus J. Merritt Dec. 1985 53 p
(NASA-TM-86783; A-85359; NAS 1.15:86783) Avail: NTIS HC A04/MF A01 CSCL 01A

The development and applications of the unsteady transonic code ATRAN3S for clean wings are discussed. Explanations of the unsteady, transonic small-disturbance aerodynamic equations that are used and their solution procedures are discussed. A detailed user's guide, along with input and output for a sample case, is given. Author

N86-31536*# Hamilton Standard, Windsor Locks, Conn.
SYSTEM DESIGN AND INTEGRATION OF THE LARGE-SCALE ADVANCED PROP-FAN
Brian P. Huth Aug. 1984 97 p
(Contract NAS3-23051)
(NASA-CR-174789; NAS 1.26:174789; HSER-9333) Avail: NTIS HC A05/MF A01 CSCL 01A

In recent years, considerable attention has been directed toward improving aircraft fuel consumption. Studies have shown that blades with thin airfoils and aerodynamic sweep extend the inherent efficiency advantage that turboprop propulsion systems have demonstrated to the higher speed to today's aircraft. Hamilton Standard has designed a 9-foot diameter single-rotation Prop-Fan. It will test the hardware on a static test stand, in low speed and high speed wind tunnels and on a research aircraft. The major objective of this testing is to establish the structural integrity of large scale Prop-Fans of advanced construction, in addition to the evaluation of aerodynamic performance and the aeroacoustic design. The coordination efforts performed to ensure smooth operation and assembly of the Prop-Fan are summarized. A summary of the loads used to size the system components, the methodology used to establish material allowables and a review of the key analytical results are given. Author

N86-31537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ANALYTICAL AND EXPERIMENTAL PERFORMANCE OF A WIND-TUNNEL DIFFUSER SECTION
Rickey J. Shyne, Royce D. Moore, and Donald R. Boldman 1986 13 p Presented at the 58th Annual Conference of the National Technical Association, Washington, D.C., 23-28 Jun. 1986
(NASA-TM-88795; E-3130; NAS 1.15:88795) Avail: NTIS HC A02/MF A01 CSCL 01A

Wind tunnel diffuser performance is evaluated by comparing experimental data with analytical results predicted by an one-dimensional integration procedure with skin friction coefficient, a two-dimensional interactive boundary layer procedure for analyzing conical diffusers, and a two-dimensional, integral, compressible laminar and turbulent boundary layer code. Pressure, temperature, and velocity data for a 3.25 deg equivalent cone half-angle diffuser

(37.3 in., 94.742 cm outlet diameter) was obtained from the one-tenth scale Altitude Wind Tunnel modeling program at the NASA Lewis Research Center. The comparison is performed at Mach numbers of 0.162 (Re = 3.097x19(6)), 0.326 (Re = 6.2737x19(6)), and 0.363 (Re = 7.0129x10(6)). The Reynolds numbers are all based on an inlet diffuser diameter of 32.4 in., 82.296 cm, and reasonable quantitative agreement was obtained between the experimental data and computational codes. Author

N86-31538# Aeronautical Research Labs., Melbourne (Australia).
A COMPUTER PROGRAM FOR CALCULATING THE STEADY AND OSCILLATORY SUPERSONIC FLOW OVER THIN WINGS
J. A. Gear Dec. 1985 28 p
(AD-A167451; ARL-STRUC-TM-424) Avail: NTIS HC A03/MF A01 CSCL 20/4

A computer program for the calculation of linearized steady and oscillatory supersonic flow over thin wings has been implemented on an ELXSI. The program uses an explicit finite difference scheme on a characteristic grid to solve for the reduce potential and pressure coefficient on the wing surface. GRA

N86-31539# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A DATA ACQUISITION SYSTEM TO AID IN THE AERODYNAMIC STUDY OF VARIOUS HELICOPTER CONFIGURATIONS M.S. Thesis
Patrick A. Witt Mar. 1986 101 p
(AD-A167717) Avail: NTIS HC A06/MF A01 CSCL 14/2

This thesis developed a data acquisition system to be used in conjunction with the 3.5' x 5.0' low speed wind tunnel at the Naval Postgraduate School. Interactive graphic programs were developed to aid in data acquisition and analysis. In addition, the internal balance was redesigned to correct problems encountered with the drag component. The balance was also instrumented to record the pitch and yaw moment components. A calibration rig was designed and constructed in order to evaluate the interactions to the different components. The equipment used and computer programs developed for data acquisition and analysis were adequate. However, balance calibration revealed problems with the calibration rig and location of the roll component strain gage. Both of these problems will have to be corrected before accurate readings can be expected from this balance design. Author (GRA)

N86-31540# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
HYPERSONIC AERODYNAMIC COEFFICIENTS AND CONVECTION FLOW ESTIMATION IN A HERMES TYPE PROJECT [PREVISION EN HYPERSONIQUE DES COEFFICIENTS AERODYNAMIQUES ET DES FLUX DES CONVECTION DANS UN PROJET TYPE HERMES]
Claude Pollak 1986 41 p In FRENCH Presented at 22nd AAAF Colloque dAerodynamique Appliquee, Lille, 13-15 Nov. 1985
(SNIAS-861-422-108; ESA-86-97596) Avail: NTIS HC A03/MF A01

An analysis of all the experimental and computation requirements of the Hermes project is presented. The discussion includes the influence of the upper atmosphere composition and possible chemical reactions, the information collected in Orbiter experiments, the possibility of utilizing plasma generators and CF4 in wind tunnel tests, the development of parabolized Navier-Stokes models and solutions, and the computing capacity requirements. ESA

N86-31541# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
COMPUTATIONS OF SEPARATED SUBSONIC AND TRANSONIC FLOW ABOUT AIRFOILS IN UNSTEADY MOTION
R. Houwink 17 Dec. 1984 14 p Presented at 3rd Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, Calif., 21-24 Jan. 1985
(Contract NIVR-1994)
(NLR-MP-84094-U; B8664045; ESA-86-97666) Avail: NTIS HC A02/MF A01

Results of unsteady separated flow computations using the LTRAN2-NLR code (low-frequency transonic small perturbation theory) coupled in strong interaction with Green's lag-entrainment method for a steady turbulent boundary layer are presented. Computations of shock-induced separation were carried out for a supercritical airfoil oscillating in pitch and for the NACA 0012 airfoil at a transient change of angle of attack. Subsonic separated flow was computed for the ONERA RA.16.SC1 airfoil with oscillating spoiler. The results are correlated with experimental data to investigate the applicability of the code. ESA

N86-31542# European Space Agency, Paris (France).
DESIGN OF A BASIC PROFILE FOR A SLIGHTLY SWEPT WING. PART 2: EXPERIMENTAL INVESTIGATION ON THE AIRFOIL DFVLR-W1 IN THE BRUNSWICK TRANSONIC WIND TUNNEL (TWB)
Georg Wichmann Sep. 1985 64 p Original language document was announced as N85-27833
(ESA-TT-916-Pt-2; DFVLR-FB-85-01-Pt-2; ESA-86-97569-Pt-2) Avail: NTIS HC A054/MF A01; original German version available from DFVLR, Cologne, West Germany DM 19.50

The airfoil DFVLR-W1 was investigated in a transonic wind tunnel at free transition in the Mach number range between 0.5 and 0.81, at a Reynolds number 6 million. The influence of different locations of transition fixing was investigated. Results are presented as aerodynamic coefficients, airfoil performance boundaries, and pressure distributions. It is shown that the design requirements are met by the airfoil. A comparison with theoretical results indicates the applicability of the computer codes are used in the design process. ESA

N86-31543# European Space Agency, Paris (France).
AERODYNAMIC DESIGN METHODS FOR MODERN TRANSPORT AIRCRAFT
Helmut Sobieczky Aug. 1985 82 p Original language document was announced as N85-27838
(ESA-TT-923; DFVLR-FB-85-05; ESA-86-97571) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 23

A concept to obtain shock free transonic flows for design aerodynamics of aircraft and turbomachinery is outlined. The method of elliptic continuation or method of fictitious gas represents a starting point for a number of operational computational procedures to obtain supercritical airfoil and wings. Design examples illustrate the value of shock free configuration for aerodynamic efficiency enhancement. The application of supercritical flow in aerodynamic concepts is mentioned. ESA

N86-31544# Institut Franco-Allemand de Recherches, St. Louis (France).
THEORETICAL STUDY OF THE BERNARD-KARMAN VORTEX PATH. APPLICATION TO THE EXPERIMENTAL STUDY OF THE FLOW AROUND A THICK OBSTACLE [ETUDE THEORIQUE DE L'ALLEE ALTERNEE DE BERNARD-KARMAN. APPLICATION A L'ETUDE EXPERIMENTALE DE L'ECOULEMENT AUTOUR D'UN OBSTACLE EPAIS]
P. Meyer, R. Kauffmann, and G. Koerber 17 Apr. 1985 68 p In FRENCH Original document contains color illustrations
(Contract DRET-84-047)
(ISL-R-105/85; ESA-86-97622) Avail: NTIS HC A04/MF A01

The classical results of the Bernard-Karman exact analytical solution are reviewed and illustrated by experimental data. These results are applied to the case of a wing profile configuration including a high incidence spoiler. The flow analysis results are accurate enough in spite of the simplicity of the equations. The addition of a viscous model makes a quite realistic wake shape. The study was applied to the development of an unsteady laser velocimetry method. ESA

N86-31545# Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATION OF AN INVISCID MULTIVORTEX MODEL TO THE CALCULATION OF THE VORTEX FLOW BEHIND AN AIRFOIL PROFILE WITH SPOILER [DER EINSATZ EINES RE-

IBUNGSFREIEN MEHRWIRBEL- MODELLS ZUR BERECHNUNG DER WIRBELSTROEMUNG HINTER EINEM TRAGFLUEGEL MIT SPOILER]

W. Czichowsky 15 Oct. 1984 71 p In GERMAN
(ISL-R-133/84; ESA-86-97621) Avail: NTIS HC A04/MF A01

The flow about an airfoil profile with spoiler was calculated using an inviscid multivortex model. This flow leads at the airfoil trailing edge and the spoiler edge to boundary layer separation and wakes with vortices. The model replaces the separated vortex boundary layers by a series of discrete potential vortices. By a conformal transformation of the outside of a circle onto the outside of a profile, the flow about a profile is reduced to the simple case of a flow about a circular cylinder with potential vortices, the complex flow potential of which is known. The intensity of the new vortices are obtained from the production of circulation in the boundary layers. The coordinates of the vortex centers are empirically fixed in the immediate vicinity of the separation edges. The vortex motions are calculated by numerical integration of the vortex differential equations. The forces on the profile are directly obtained from the generalized Blasius formula for unsteady flows. For the supercritical profile RA16-SC1 with a 40 deg arc spoiler, the formation and separation of vortices, the evolution of the circulation production rate in the boundary layers, and aerodynamic coefficients are obtained. ESA

N86-31546# European Space Agency, Paris (France).
CALCULATION OF SEPARATED LAMINAR SUPERSONIC FLOWS OVER BLUNT BODIES OF REVOLUTION AT ZERO ANGLE OF ATTACK

Bernhard Mueller Dec. 1985 144 p Original language document was announced as N86-14256
(ESA-TT-953; DFVLR-FB-85-30; ESA-86-97801) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, West Germany DM 40.50

The applicability of the thin layer approximation method for the description of thin separation bubbles and large separation areas and data acquisition on the structure of separated three dimensional flow distribution is studied using the numerical simulation of separated laminar supersonic flows over blunt bodies of revolution. The influence of numerical damping on the consistency, stability, convergence and accuracy of the finite difference scheme of Beam and Warming is studied. The topologic structure of the separation area depends on the Reynolds number. The thin layer approximation allows an accurate description of flows with small or large separation areas at high Reynolds numbers. ESA

N86-31547# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Grenzschichten und Unterschallstroemungen.
WALL SHEAR STRESS MEASUREMENTS ON A PROLATE SPHEROID AT ZERO INCIDENCE IN THE GERMAN-NETHERLANDS WIND (DNW) TUNNEL

Hans-Peter Kreplin, Hans Ulrich Meier, Edzard Mercker, and Andreas Landhaeusser Feb. 1986 41 p
(DFVLR-Mitt-86-06; ISSN-0176-7739; ESA-86-97822) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 11.50

Surface hot film measurements were carried out on a prolate spheroid in the three closed test sections of a wind tunnel. For axisymmetric flow conditions the regions of laminar-turbulent boundary layer transition were determined from measured wall shear stress distributions and instantaneous hot film signals. The results clearly indicate that the location of the boundary layer transition moves downstream at a given tunnel Reynolds number as the turbulence intensity decreases with increasing nozzle contraction. ESA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-31548*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA'S AIRCRAFT ICING ANALYSIS PROGRAM

Robert J. Shaw 1986 26 p Presented at the International Conference of the Aeronautical Sciences (ICAS), London, England, 7-12 Sept. 1986
(NASA-TM-88791; E-3121; NAS 1.15:88791) Avail: NTIS HC A03/MF A01 CSCL 01C

An overview of the NASA ongoing efforts to develop an aircraft icing analysis capability is presented. Discussions are included of the overall and long term objectives of the program as well as current capabilities and limitations of the various computer codes being developed. Descriptions are given of codes being developed to analyze two and three dimensional trajectories of water droplets, airfoil ice accretion, aerodynamic performance degradation of components and complete aircraft configurations, electrothermal deicer, fluid freezing point depressant antideicer and electro-impulse deicer. The need for bench mark and verification data to support the code development is also discussed, and selected results of experimental programs are presented. Author

N86-31549# Test Wing (4950th), Wright-Patterson AFB, Ohio.
FIREPROOF HYDRAULIC BRAKE SYSTEM Final Report, May - Nov. 1985

Michael W. Dillard Apr. 1986 66 p
(AD-A167774; Rept-4950/FTR-86-1) Avail: NTIS HC A04/MF A01 CSCL 13/7

The Fireproof Hydraulic Brake System (FHBS) flight test program verified that the FHBS is a feasible method of eliminating aircraft hydraulic fluid fires ignited by hot brakes. The FHBS uses a new nonflammable hydraulic fluid, chlorotrifluoroethylene (CTFE), in the wheel well and landing gear area while retaining standard hydraulic fluid (MIL-H-5606) in the rest of the aircraft hydraulic system. The two fluids were separated downstream of the antiskid valve by a reservoir/separator unit. A C-135E was used as the test aircraft. The modification consisted of instrumentation to monitor brake system parameters and the FHBS installation for the left outboard wheel pair. The testing consisted of maximum effort braking runs at light aircraft gross weights to induce antiskid cycling. The FHBS was evaluated subjectively by the test pilot and objectively by comparing its performance with that of the standard C-135 brake system established by baseline testing. GRA

N86-31550# Army Aviation Systems Command, St. Louis, Mo.
FULL-SCALE CRASH TEST (T-41) OF THE YAH-63 ATTACK HELICOPTER

Kent F. Smith Apr. 1986 99 p
(AD-A167813; USAAVSCOM-TR-86-D-2) Avail: NTIS HC A05/MF A01 CSCL 01/3

T-41 was jointly conducted by the Aviation Applied Technology Directorate and the NASA-Langley Research Center. The purpose of the effort was to assess the effectiveness of the structural crashworthiness features designed into the YAH-63 during a severe but potentially survivable accident and to evaluate the performance of several developmental crashworthy systems in a real-world helicopter crash environment. Because this was the first crash test of an attack helicopter and the first of a helicopter having designed-in crashworthiness, T-41 offers unique data for predicting the crash impact behavior of future helicopters. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-31551*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMULATION EVALUATION OF DISPLAY/FLIR CONCEPTS FOR LOW-ALTITUDE, TERRAIN-FOLLOWING HELICOPTER OPERATIONS
Harry N. Swenson, Clyde H. Paulk, Jr., Robert L. Kilmer (IBM Federal Systems Div., Owego, N. Y.), and Frank G. Kilmer Dec. 1985 13 p
(NASA-TM-86779; Rept-85349; NAS 1.15:86779) Avail: NTIS HC A02/MF A01 CSCL 17G

A piloted simulation of three head-down display (HDD) concepts with flight-director guidance superimposed on forward-looking infrared (FLIR) imagery was performed to evaluate the task of low-level, terrain-following (TF), manual helicopter flight. The three display concepts were examined for the purpose of finding ways by which aircraft flight-attitude and command symbols and FLIR imagery could be integrated onto one instrument. In all cases, the FLIR imagery was centered on the flight-path vector of the aircraft. The three displays were then characterized by having: (1) pitch attitude conformal to the FLIR imagery; (2) pitch attitude conformal to the FLIR imagery, but with an increase in the scaling; and (3) pitch attitude nonconformal to the FLIR imagery with the same pitch scaling as in (2). The simulation was conducted on the Vertical Motion Simulator (VMS) at Ames Research Center, using NASA and Air Force test pilots. The pilots indicated that the nonconformal pitch attitude and FLIR display was the preferred way to display information because of the absence of pitch-attitude information on displays (1) and (2) during some portions of the operational flight envelope. Author

N86-31552# Department of the Air Force, Washington, D.C.
PORTABLE GLIDE SLOPE INDICATOR Patent Application
Harry L. Task, inventor (to Air Force) Filed 26 Jan. 1986 15 p
(AD-D012240; US-Patent-Appl-SN-823872) Avail: NTIS HC A02/MF A01 CSCL 17/7

An improved glide slope indicator system for facilitating aircraft landings under adverse lighting conditions on remote or austere landing sites is provided which comprises a pair of indicators deployable near ground level on each side of a runway, each indicator including a housing having an optical window and a pair of light sources mounted in predetermined spaced relationship to each other and to the optical window and connected to a power source and related circuitry to project a well defined first blinking and second steady light beam of predetermined angular divergence and overlap, one indicator disposed to project beams with an overlap elevated at a first angle relative to horizontal and the other indicator disposed to project beams with an overlap elevated at a second angle relative to horizontal different from the first, with a preselected glide path lying between the two overlaps. An infrared filter may be included in each indicator to project beams observable only with infrared sensitive viewing aids. The system may be battery powered for portability. GRA

N86-31553# Army Engineer Topographic Labs., Fort Belvoir, Va.
A COST/PERFORMANCE ANALYSIS OF HYBRID INERTIAL/EXTERNALLY REFERENCED POSITIONING/ORIENTATION SYSTEMS
Eugene J. Rose, Sam C. Bose, James T. Kouba, and David A. Sobek Sep. 1985 23 p
(AD-A167685; ETL-R-086) Avail: NTIS HC A02/MF A01 CSCL 17/7

Combining inertial positioning or navigation systems with externally referenced aids such as the Global Positioning System (GPS) or the U.S. Army's Position Location Reporting System (PLRS) will result in significant improvements over one of these systems acting on its own. These improvements will include lower cost, since less accurate inertial systems can be used during periods when the external reference is unavailable; better immunity to jamming than in the case of only an externally referenced system; and higher accuracy than can be obtained with only an inertial system. This paper presents the results of an analysis of the position, heading, and attitude accuracies which can be obtained using various combinations of inertial and externally referenced systems. A computer simulation was performed to incorporate extensive error models for all of the sensors involved. A 24-state Kalman filter was used to control the errors. In addition, a cost versus performance analysis is presented based on representative subsystem costs and hybridization considerations. GRA

N86-31554# Arinc Research Corp., Annapolis, Md.
EVALUATION OF ALTERNATIVES FOR AN ARMY PRECISION LANDING SYSTEM Final Report
R. Lancaster, R. Lewsen, and B. Mitchell Sep. 1985 130 p
(Contract DAEA18-84-C-0127)
(AD-A167780; Rept-2959-01-1-3759) Avail: NTIS HC A07/MF A01 CSCL 17/7

This study was conducted to determine the need for Army Precision Landing System requirements for aviation deployment in the combat zone. The study identifies the need and best approaches for satisfying Army requirements within air traffic management functions, applying current tactical doctrine. Existing landing systems are compared with alternate systems not presently developed or fielded from a technical and operational viewpoint. Availability, operational concepts, and cost data are analyzed for each proposed system. The study also developed strengths and weaknesses of the existing, as well as proposed precision landing systems for ATC. Final results and recommendations to support air traffic control requirements on the battlefield beyond the year 2000 are depicted. GRA

N86-31555# Federal Aviation Administration, Atlantic City, N.J.
LORAN C 1984 SPRING-SUMMER STABILITY
Frank Lorge Mar. 1986 81 p
(AD-A167867; DOT/FAA/CT-TN86/10) Avail: NTIS HC A05/MF A01 CSCL 17/7

The report describes a flight test designed to examine Loran C seasonal stability. Flights were conducted in the spring and summer of 1984. Plot data are presented which show seasonal shifts in signal-to-noise ratio, envelope-to-cycle discrepancy, and time differences across the continental United States. A later report will compare these data to new data collected in the winter season. GRA

N86-31556# Aeronautical Research Labs., Melbourne (Australia).
ANALYSIS OF A MIRROR DECK LANDING AID
A. Ross Feb. 1986 64 p
(AD-A167988; ARL/SYS-TM-86) Avail: NTIS HC A04/MF A01 CSCL 01/4

This report provides details of the MDLA system, installation details and calculations concerning performance, coverage, calibration and accuracy requirements. A graphical method of presenting operational settings for height and elevation is described, as also is a simplified technique for calibration. GRA

N86-31557# Bonn Univ. (West Germany). Geodaetisches Inst.
DEVELOPMENT OF A RECEIVER CONCEPT FOR GEODETIC APPLICATION OF THE NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) SATELLITE NAVIGATION SYSTEM Final Report, Feb. 1985
Erich Saur Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 25 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-036; ISSN-0170-1339; ESA-86-97474) Avail: NTIS

HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.50

The instrument measurement errors in a GPS receiver (a coherent C/A code cross-correlation receiver with carrier phase measurements and higher process gain, capable of using the P code modulated L2 frequency) are studied. The GPS receiver consists of a ZF amplifier, a mixing frequency preparation unit, and a digital signal processing unit including a code generator, a correlator, a numerical oscillator, and control and evaluation computers. The geodetic GPS receiver is analyzed as regards mobility, human factors engineering, interference, possible connections, and independence from external data sources. The cost effective multiplex scheme is selected for simultaneous measurements of four satellites leading to signal delay reduction. A subminiature rubidium standard is used as a receiver black to avoid loss of accuracy at higher integration times. ESA

N86-31558# European Space Agency, Paris (France).
A FEASIBILITY STUDY FOR THE USE OF ELECTRONIC FLIGHT STRIPS IN AIR TRAFFIC CONTROL (ATC) CONTROLLER WORKSTATIONS
Juergen Grigat and Josef Thomas Oct. 1985 89 p Original language document was announced as N85-31039
(ESA-TT-928; DFVLR-FB-85-08; ESA-86-97572) Avail: NTIS HC A05/MR A01; original German version available from DFVLR, Cologne, West Germany DM 47

Flight progress strip importance in air traffic control was studied and a concept for flight strip representation on electronic displays supported by an automatic data exchange between adjacent control stations and adapted to the ATMOS (Air Traffic Management and Operations Simulator) air traffic control simulator was developed. Data important for executive controllers and for schedule controllers per sector and per flight are displayed on two different screens. The concept allows a rapid exact data exchange to all workstations and a reduction in the controllers data acquisition so that they can dedicate their attention to approach monitoring. Pilot communications are also reduced. The feasibility of the concept is demonstrated in a case study. ESA

N86-31559# European Space Agency, Paris (France).
TENDENCIES FOR LIBERALIZATION IN EUROPEAN AIR TRANSPORT
Rolf Juergen Haupt and Paul-Juergen Weber Dec. 1985 160 p Original language document was announced as N86-10030
(ESA-TT-947; DFVLR-FB-85-23; ESA-86-97580) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 37.50

Deregulation of European air transportation is discussed. Aim and content of proposed or decided regulations are considered, and proposals for the further development of the air transport system are offered. Aspects of competition, market entry, and tariff regulations are presented and the fundamentals of air transport policy of Great Britain, Federal Republic of Germany, and the Netherlands are described, indicating the points of view of the air transport managers (governments, airlines, and travel agencies) and of the users. ESA

N86-31560# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
COURSE ON RADIOPOSITIONING
G. Bakker, J. C. deMunck, and G. L. StrangvanHees 1985 343 p Presented at Delft Univ. of Technology, Netherlands, 14-17 Jan. 1985
(ESA-86-98039) Avail: NTIS HC A15/MF A01

Matrices and least squares adjustment used in radiopositioning are introduced. Testing of geodetic networks; signals and systems (wave propagation, geometry and signals); survey computations (geodetic coordinates and datum transformation, reductions to ellipsoid, conformal mapping, computations on the sphere and ellipsoid); and adjustment of hyperbolic patterns and Kalman filtering are explained. ESA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-31561 Ecole Polytechnique, Palaiseau (France).
AERIAL COMBAT [COMBAT AERIEN]
5 Dec. 1985 36 p In FRENCH Presented at Journee Nationale Science et Defense, Palaiseau, France, 5 Dec. 1985
(ESA-86-97271) Avail: Issuing Activity

The development trends of combat aircraft technology are discussed. The analysis of the operational environment problems includes target assignment, target identification, and radar signatures. Fighter design trends and missile evolution are discussed. It is shown that a single missile type can accomplish short range and out of sight missions by combining inertial and optical guidance systems. The ergonomic aspects of fighter design are examined. ESA

N86-31562*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN-FLIGHT PHOTOGRAMMETRIC MEASUREMENT OF WING ICE ACCRETIONS
Robert C. McKnight, Richard L. Palko (Calspan Field Services, Inc., Arnold AFS, Tenn.), and Robert L. Humes 1986 14 p Presented at the 24th Aerospace Sciences Meeting, Reno, Nev., 6-8 Jan. 1986; sponsored by AIAA
(NASA-TM-87191; E-2847; NAS 1.15:87191) Avail: NTIS HC A02/MF A01 CSCL 01C

A photographic instrumentation system was developed for the Lewis icing research aircraft to measure wind ice accretions during flight. The system generates stereo photographs of the accretions which are then photogrammetrically measured by the Air Force Arnold Engineering and Development Center. The measurements yield a survey of spatial coordinates of an accretion's surface to an accuracy of at least + or - 0.08 cm. The accretions can then be matched to corresponding icing cloud and aerodynamic measurements. The system is being used to measure rime, mixed, and clear natural ice accretions. Author

N86-31563*# National Aeronautics and Space Administration, Washington, D.C.
MISSION ADAPTIVE WING SOARS AT NASA FACILITY
Debra Rahn and Leslie Reinertson (National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.) 29 Aug. 1986 2 p
(P86-10182) Avail: NTIS HC A02/MF A01 CSCL 01C

Research pilots have flown the Mission Adaptive Wing (MAW) aircraft, a highly modified F-111 jet fighter, from subsonic speeds up to Mach 1.4 in initial flight tests. The inital test flights are clearing the envelope with the wings flexed at various curvatures. This process allows further research data to be safely gathered so that designers of future variable camber wing aircraft have the best information possible. The altitude envelope was cleared from 27,500 down to 7,500 feet where denser air can cause more stress on the aircraft. Testing with the aircraft was conducted with wing sweep angles of 26 and 58 degrees. At the conclusion of the performance tests in the manual configuration, the system will be reconfigured for automatic mode tests. The limited automatic modes include maneuver camber control where the wings are deflected automatically to the best lift versus drag combination for a particular speed; cruise camber control which can help protect the aircraft from high G stresses; and maneuver enhancement/gust alleviation which is designed to improve the aircraft's up and down movement response to pilot commands and reduce the aircraft response to turbulence. B.G.

N86-31564# Federal Aviation Administration, Washington, D.C.
ADVISORY CIRCULAR: DESIGN CONSIDERATIONS TO PROTECT FUEL SYSTEMS DURING A WHEELS-UP LANDING

24 Jul. 1986 4 p
(FAA-AC/25.994-1) Avail: NTIS HC A02/MF A01

Guidelines and methods for complying with the requirements of the Federal Aviation Regulations (FAR) are presented. These guidelines pertain to protecting fuel system components located in the engine nacelles and the fuselage from damage which could result in spillage of enough fuel to constitute a fire hazard as a consequence of a wheels-up landing on a paved runway.
Author

N86-31565# Societe Nationale Industrielle Aerospatiale, Paris (France).
ANEMOBAROMETRY IN FLIGHT CONTROL. A-320 AERODYNAMICS. THE TURBOREACTORS AIR INLET [L'ANEMOBAROMETRIE: ELEMENT ESSENTIEL DE LA CONDUITE DU VOL. AERODYNAMIQUE A-320. ENTREE D'AIR DES TURBOREACTORS]
1985 10 p In FRENCH Presented at the Aeronautique Toulouse 2000, Toulouse, France, Dec. 1985; sponsored by Confederation Francaise de l'Encladrement CGC
(SNIAS-861-111-114; ESA-86-97592) Avail: NTIS HC A02/MF A01

The utilization and calibration of barometric altimeters and the design and wind tunnel verification of the aerodynamic characteristics of the A-320 aircraft turbojet engine air intake are discussed. For individual titles, see N86-31566 through N86-31567.

N86-31566# Societe Nationale Industrielle Aerospatiale, Paris (France).
ANEMOBAROMETRY: AN ESSENTIAL ELEMENT OF FLIGHT CONTROL [L'ANEMOBAROMETRIE: ELEMENT ESSENTIEL DE LA CONDUITE DU VOL] **c08**
J. Bardou *In its* Anemobarometry in Flight Control. A-320 Aerodynamics. The Turboreactors Air Inlet 1985 3 p In FRENCH
(For primary document see N86-31565 23-05)
Avail: NTIS HC A02/MF A01

The exploitation of the atmospheric pressure to determine flight altitude is reviewed and the calibrating procedures are described. The utilization of ground based radars and towed cones in calibrating anemometric altimeters is discussed. An analysis of the measurement errors is included. ESA

N86-31567# Societe Nationale Industrielle Aerospatiale, Paris (France).
THE A-320 AERODYNAMICS. THE TURBOREACTOR AIR INLET [AERODYNAMIQUE A-320. ENTREE D'AIR DES TURBOREACTORS]
Andre Condaminas *In its* Anemobarometry in Flight Control. A-320 Aerodynamics. The Turboreactors Air Inlet 1985 6 p In FRENCH
(For primary document see N86-31565 23-05)
(Note-427.021/86) Avail: NTIS HC A02/MF A01

The design of air inlets is discussed and the solution adopted for the A-320 aircraft engines is described. The tests performed in wind tunnel are detailed. The results show that the flow around the nacelle is in agreement with the specifications in the whole range of operational Mach number and incidence angles. ESA

N86-31568*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT TEST OF PASSIVE WING/STORE FLUTTER SUPPRESSION
F. W. Cazier, Jr. and M. W. Kehoe Aug. 1986 27 p Presented at the 1986 Aircraft/Stores Compatibility Symposium, Wright-Patterson AFB, Ohio, 8-10 Apr. 1986
(NASA-TM-87766; NAS 1.15:87766) Avail: NTIS HC A03/MF A01 CSCL 01C

Flight tests were performed on an F-16 airplane carrying on each wing an AIM-9J wingtip missile, a GBU-8 bomb near midspan, and an external fuel tank. Baseline flights with the GBU-8 mounted on a standard pylon established that this configuration is characterized by an antisymmetric limited amplitude flutter oscillation within the operational envelope. The airplane was then flown with GBU-8 mounted on the decoupler pylon. The decoupler pylon is a NASA concept of passive wing-store flutter suppression achieved by providing a low store-pylon pitch frequency. The decoupler pylon successfully suppressed wing-store flutter throughout the flight envelope. A 37 percent increase in flutter velocity over the standard pylon was demonstrated. Maneuvers with load factors to 4g were performed. Although the static store displacements during maneuvers were not sufficiently large to be of concern, a store pitch alignment system was tested and performed successfully. One GBU-8 was ejected demonstrating that weapon separation from the decoupler pylon is normal.
Author

N86-31569# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE APPLICATION OF ENERGY TECHNIQUES TO PROPELLER-DRIVEN AIRPLANES M.S. Thesis
Douglas B. Youngblood Dec. 1985 92 p
(AD-A167113; AFIT/CI/NR-86-53T) Avail: NTIS HC A05/MF A01 CSCL 01/2

This thesis examines the validity of using the energy technique on propeller-driven aircraft during a climb analysis. It compares an accepted subsonic aircraft climb analysis method (pure potential energy increase) with an acceleration analysis procedure (pure kinetic energy increase) that has been a subject of criticism when used within a subsonic flight test program because of aircraft power limitations and flight test assumptions. The energy-state approximation was applied to a subsonic, propeller-driven aircraft using both a sawtooth climb analysis procedure and level acceleration method. Results showed that energy techniques, i.e., correlation between sawtooth and level acceleration methods, are a valuable support tool to the previously isolated potential energy (sawtooth climb) method. Data demonstrated a test time savings of approximately 7:1 with a variance in overall correlation that, although not within acceptable standards, is believed to be reducible with a more dedicated instrumentation selection. Data correlation suggested good agreement on best rate-of-climb speed determination. However, this should be an asset in reducing the time previously required for determination of excess thrust horsepower. Further testing, specifically with the level acceleration method, using higher resolution data acquisition equipment (with possibly an accelerometer) would fully demonstrate the extent of unaccountable losses and resulting disagreement between the two methods.
GRA

N86-31570# Boeing Military Airplane Development, Seattle, Wash.
VULNERABILITY METHODOLOGY AND PROTECTIVE MEASURES FOR AIRCRAFT FIRE AND EXPLOSION HAZARDS. VOLUME 2: AIRCRAFT ENGINE NACELLE FIRE TEST PROGRAMS. PART 1: FIRE DETECTION, FIRE EXTINGUISHMENT AND SURFACE IGNITION STUDIES Final Report, Feb. 1981 - Oct. 1984
A. M. Johnson and A. F. Grenich Jan. 1986 279 p
(Contract F33615-78-C-2063)
(AD-A167356; D180-28861-1; AFWAL-TR-85-2060-V-2-Pt-1) Avail: NTIS HC A13/MF A01 CSCL 01/3

Fire tests and extinguishant concentration tests were conducted using a simulated portion of the F-16 aircraft engine compartment in the Aircraft Engine Nacelle (AEN) fire test simulator at WPAFB. Combat damage simulation included outer compartment wall penetration allowing either inflow or outflow of ventillation airflow through and external wound and fan perforation or engine bleed air line damage. Standard fire and agent concentration test techniques were developed. Existing specifications were found to be adequate in terms of quantity of fire extinguishing agent. Results also indicated that more rapid agent release resulted in more effective use of the agent. Halon 1301 performed significantly better than Halon 1202, contrary to what the available literature indicated. Fires with combat damage inflow simulation added were the most difficult to extinguish because hot surface ignition sources were created soon after the test fire was ignited. For these, the quantity of agent specified would have been adequate only if the agent reached the fire within a few seconds after ignition. GRA

N86-31571# Boeing Military Airplane Development, Seattle, Wash.
VULNERABILITY METHODOLOGY AND PROTECTIVE MEASURES FOR AIRCRAFT FIRE AND EXPLOSION HAZARDS. VOLUME 1: EXECUTIVE SUMMARY Final Report, Feb. 1981 - Oct. 1984
A. F. Grenich Jan. 1986 40 p
(Contract F33615-78-C-2063)
(AD-A167443; D180-28860-1-Vol-1; AFWAL-TR-85-2060-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13/12

This report summarizes the research conducted by the contractor on airplane engine compartment and fuel tank fire safety research. The value of ground testing, using the Aircraft Engine Nacelle (AEN) and the Simulated Aircraft Fuel Tank Environment (SAFTE) facilities, was clearly evident as the testing proceeded. Extinguishant tests of simulated nacelle fires indicated that current criteria for extinguishant concentration and duration were more than adequate for intact nacelles inert gas generator systems (OBIGGS) revealed that both the permeable membrane and molecular sieve adequately inerted the test fuel tank. However, some minor operational difficulties were experienced with both test units which would have to be corrected prior to producing flight hardware. GRA

N86-31572# Boeing Military Airplane Development, Seattle, Wash.
VULNERABILITY METHODOLOGY AND PROTECTIVE MEASURES FOR AIRCRAFT FIRE AND EXPLOSION HAZARDS. VOLUME 2: AIRCRAFT ENGINE NACELLE FIRE TEST PROGRAMS. PART 2: SMALL SCALE TESTING OF DRY CHEMICAL FIRE EXTINGUISHANTS Final Report, Feb. 1981 - Oct. 1984
L. A. Desmarais Jan. 1986 279 p
(Contract F33615-78-C-2063)
(AD-A167444; D180-28862-Vol-2-Pt-2; AFWAL-TR-85-2060-Vol-2-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 01/2

Dry chemical fire extinguishing agents were studied in a simulated small scale aircraft engine nacelle environment to observe the ability of these agents to prevent re-ignition, a known deficiency of the presently used gaseous agents. An injector was developed which effectively dispersed agent into the airstream; a fuel spray behind a flameholder, ignited and sustained by a hot surface, was used as the test scenario. The agents were found to be effective in very small quantities (less than 30 grams) for initial suppression of the fire, but permanent extinguishment was found to be a function of test conditions. The agents tended to accumulate on test surfaces and cause some corrosion as the result of repeated applications but were easily cleaned from affected surfaces. GRA

N86-31573# Boeing Military Airplane Development, Seattle, Wash.
VULNERABILITY METHODOLOGY AND PROTECTIVE MEASURES FOR AIRCRAFT FIRE AND EXPLOSION HAZARDS. VOLUME 3: ON-BOARD INERT GAS GENERATOR SYSTEM (OBIGGS) STUDIES. PART 2: FUEL SCRUBBING AND OXYGEN EVOLUTION TESTS Final Report, Feb. 1981 - Oct. 1984
P. M. McConnell, G. A. Dalan, and C. L. Anderson Jan. 1986 84 p
(Contract F33615-78-C-2063)
(AD-A167445; AFWAL-TR-85-2060-Vol-3-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 01/2

A basic consideration in designing an on-board inert gas generator system (OBIGGS) is to manage the evolution of dissolved oxygen in the fuel such that an inert ullage is maintained. Fuel scrubbing, in which an inert gas is bubbled through the fuel, is the common method of removing dissolved oxygen. Analytical modeling of the scrub gas requirements for fuel scrubbing required experimental data for validation. Tests were conducted to determine if a model based on the ideal gas law, published solubility coefficients, and partial pressure relationships was valid. The excellent agreement between calculated results and test data verified that such a model is valid. GRA

N86-31574# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AERIAL REFUELING EVALUATION OF THE CH-47D HELICOPTER Final Report, 6-9 Aug. 1985
Robert D. Robbins, Patrick J. Sullivan, and Michael K. Herbst Aug. 1985 56 p
(AD-A167575) Avail: NTIS HC A04/MF A01 CSCL 01/3

A feasibility evaluation of aerial refueling the Boeing Vertol CH-47D helicopter (USA S/N 84-24159) equipped with a Boeing Vertol designed prototype aerial refueling system was conducted by the US Army Aviation Engineering Flight Activity (USAAEFA). Aerial refueling operations were performed with an HC-130P tanker aircraft and included a tanker turbulence evaluation, handling qualities while performing refueling procedures, and prototype aerial refueling system operations. Twenty-five refueling probe to drogue engagements were performed. During one engagement, 5070 pounds of fuel were transferred from the tanker to the CH-47D. Six shortcomings, all of which were related to the aerial refueling system, were identified for correction in the production design. The most significant of these was the increased maintenance requirements imposed by the use of refueling probe restraint cables. Within the limited scope of this evaluation aerial refueling of the CH-47D helicopter is a feasible concept. GRA

N86-31575# Naval Postgraduate School, Monterey, Calif.
A TRADE-OFF STUDY OF TILT ROTOR AIRCRAFT VERSUS HELICOPTERS USING VASCOMP 2 AND HESCOMP M.S. Thesis
Thomas P. Walsh Mar. 1986 218 p
(AD-A167719) Avail: NTIS HC A10/MF A01 CSCL 01/3

Trade-off studies were conducted wherein two versions of tilt rotor aircraft were examined to determine optimum mission distances where the tilt rotor designs were superior to a comparable contemporary (pure) helicopter. Two FORTRAN computer programs (VASCOMP 2 and HESCOMP) were used to predict aircraft performance. Program results were validated using data from independent sources. A simplified user's manual is included (with sample data and program output) for VASCOMP 2. The experimental results substantiate that the V-22, designated to replace the CH-46F among other aircraft, will offer significant improvements in speed, loiter endurance, hover endurance, performance, and efficiency. The results lend further credence to the manufacturer's claims that tilt rotor aircraft can transport more passengers/payload over longer distances in less time than conventional helicopters while retaining the important advantage of vertical takeoff and landing. It is acknowledged that the tilt rotor can readily perform transport missions using less fuel than helicopters but if a large percentage of hovering flight is required, conventional rotary wing aircraft are far more efficient from a fuel consumption standpoint. However, they do not have the staying power that the tilt rotor demonstrates. GRA

N86-31576# Sandia National Labs., Albuquerque, N. Mex.
AIRBORNE INTRUDER DETECTION CONSIDERATIONS
R. P. Syler Feb. 1986 5 p Presented at the Carnahan Conference on Security, Lexington, Ky., 14 May 1986
(Contract DE-AC04-76DP-00789)
(DE86-006462; SAND-85-2236; CONF-860519-4) Avail: NTIS HC A02/MF A01

This paper addresses the considerations the DOE-OSS is giving to the airborne threat to their sensitive facilities. They are working towards establishing prohibited airspace over these facilities and tasked SNL to study the techniques for monitoring this airspace. The SNL study looked at various technologies that might be employed to monitor designated airspace. The results of the study indicate that certain dedicated radar systems are candidates, but that alternatives to these are needed. SNL is presently working on developing a system utilizing FAA ASR data at the DOE facilities, and on a seismic-acoustic helicopter detector system; these are possible alternatives to dedicated radars. DOE

N86-31577# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Luftfahrt.
TECHNOLOGY DEMONSTRATION FOR INVESTIGATION OF THE NEW POSSIBILITIES OF AMPHIBIOUS FLYING BOATS, PHASE 2 Final Report, Dec. 1984
Gerhard Kriechbaum Bonn, West Germany Bundesministerium

fuer Forschung und Technologie Dec. 1985 201 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-022; ISSN-0170-1339; ESA-86-97466) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 36.50

The effects of new technologies on the amphibious flying boat open-sea capability, efficiency, and economical and flexible application were studied during a flight test program. Configuration and manufacture are described and technical characteristics are presented. Tests were performed on land, in water (inland water areas) and at sea to determine the corrosion resistance, the effects of the introduction of fiber composite materials in wings, and the all-weather landing procedures for amphibious aircraft. The craft can be used in open sea and does not require a maintenance and overhaul infrastructure, and shows good resistance to corrosion in salty water. The development of shock-absorbing fiber composite material structures is recommended. ESA

N86-31578# European Space Agency, Paris (France).
INVESTIGATIONS IN LANDING PROCESS OF AIRCRAFT BY MEANS OF THE MONTE-CARLO METHOD
Hanns-Juergen Peters Dec. 1985 109 p Original language document was announced as N86-14269
(ESA-TT-951; DFVLR-FB-85-27; ESA-86-97583) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne, West Germany DM 35.50

A landing approach simulation model based on the data from a civil airport and on the Monte Carlo theory is developed using the General Purpose Simulation System on FORTRAN 4. The model is improved to investigate the landing process with constant and variable landing times. The theoretical landing time distribution with waiting times verified with the Chi-square test show good agreement with the empirical landing time distribution. The turn time and landing time distribution with waiting time parameters are verified by statistical comparison of the simulated distribution and the empirical one. The efficiency of the test distributions is improved with a relevant landing time delimitation. The test distributions are tested successfully in other airports. ESA

N86-31579# European Space Agency, Paris (France).
USER'S MANUAL FOR THE FALCON SYSTEM
Dec. 1985 110 p Original language document was announced as N86-10721
(ESA-TT-936; DFVLR-Mitt-85-08; ESA-86-97800) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne, West Germany DM 36.50

The user manual for the meteorological research aircraft Falcon E, operated by DFVLR, is presented. The system and its technical data are described. The meteorological mission possibilities are discussed, and measuring compaigns are reviewed. Basic and special equipment is described. The onboard data acquisition system and the operational data evaluation programs are discussed. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N86-31580# Federal Aviation Administration, Washington, D.C. Program Engineering and Maintenance Service.
CHARACTERISTICS OF ALTITUDE ERROR AT REDUCED QUANTIZATION Final Report
Gene A. Wong Aug. 1986 33 p
(FAA/PM-86/35) Avail: NTIS HC A03/MF A01 CSCL 01D

An analysis of the impact of reducing the quantization level on the altitude error produced by the altimetry system is described. Specifically, the mean and the standard deviation of the altitude error at the output of the aircraft's onboard quantization device are derived assuming altitude error at its input is normally distributed. The formulae derived are very general, exact, and applicable to all ranges of input statistics and quantization levels. A computer program was written to evaluate the impact of reduced quantization for a wide range of input error standard deviation and several quantization levels. Additionally, a comparison is made between the commonly used and approximate uniform distribution model method and the exact formulae derived herein for calculating the quantized altitude error. Author

N86-31581# Koninklijk Inst. voor de Marine, Den Helder (Netherlands).
FLIGHT DATA RECORDERS (FDR) AND/OR COCKPIT VOICE RECORDERS (CVR) IN THE LOCKHEED ORION P-3C UPDATE 2 [FDR EN/OF CVR IN DE LOCKHEED ORION P-3C UPDATE 2]
J. J. Coorens Jul. 1984 136 p In DUTCH and ENGLISH
(ESA-86-97395) Avail: NTIS HC A07/MF A01

Installation of Flight Data Recorder/Cockpit Voice Recorder (FDR/CVR) combinations in the P-3C Update aircraft is discussed. Requirements, design and development, and feasibility aspects of FDRs and CVRs are treated. Examples of existing systems (e.g., the U.S. Navy Universal Locator Airborne Data Systems, and the solid-state FDR) are given. Aircraft accident relevant information, necessary adaptions of the P-3 aircraft, and feasibility were investigated. Because of the high FDR cable system costs, installation of only a CVR is concluded to be the most feasible solution. ESA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-31582*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL GAS TURBINE COMBUSTOR EXPERIMENTAL STUDY: COMPLIANT METAL/CERAMIC LINER AND PERFORMANCE EVALUATION
Waldo A. Acosta (Army Aviation Research and Development Command, Cleveland, Ohio) and Carl T. Norgren 1986 16 p Presented at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; sponsored by AIAA, ASME, SAE, and ASEE
(NASA-TM-87304; E-3016; NAS 1.15:87304) Avail: NTIS HC A02/MF A01 CSCL 21E

Combustor research relating to the development of fuel efficient small gas turbine engines capable of meeting future commercial and military aviation needs is currently underway at NASA Lewis. As part of this combustor research, a basic reverse-flow combustor has been used to investigate advanced liner wall cooling techniques. Liner temperature, performance, and exhaust emissions of the experimental combustor utilizing compliant metal/ceramic liners were determined and compared with three previously reported combustors that featured: (1) splash film-cooled liner walls; (2) transpiration cooled liner walls; and (3) counter-flow film cooled panels. Author

N86-31583*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VISUALIZATION OF FLOWS IN A MOTORED ROTARY COMBUSTION ENGINE USING HOLOGRAPHIC INTERFEROMETRY
Yolanda R. Hicks, Harold J. Schock, James E. Craig (Spectron Development Labs., Inc., Costa Mesa, Calif.), Holly L. Umstatter, and David Y. Lee 1986 15 p Presented at the 22nd Joint

Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; sponsored by AIAA, ASME, SAE and ASEE
(NASA-TM-88804; E-3148; NAS 1.15:88804; AIAA-86-1557) Avail: NTIS HC A02/MF A01 CSCL 21E

The use of holographic interferometry to view the small- and large-scale flow field structures in the combustion chamber of a motored Wankel engine assembly is described. In order that the flow patterns of interest could be observed, small quantities of helium were injected with the intake air. Variation of the air flow patterns with engine speed, helium flow rate, and rotor position are described. The air flow at two locations within the combustion chamber was examined using this technique. Author

N86-31584*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF A 20 KILOHERTZ POWER DISTRIBUTION SYSTEM
Irving G. Hansen Aug. 1986 7 p Presented at the 21st Intersociety Energy Conversion Engineering Conference, San Diego, Calif., 25-29 Aug. 1986; cosponsored by ACS, SAE, ANS, ASME, IEEE, AIAA, and AIChE
(NASA-TM-87346; NAS 1.15:87346) Avail: NTIS HC A02/MF A01 CSCL 21E

A single phase, 440 VRMS, 20 kHz power distribution system with a regulated sinusoidal wave form is discussed. A single phase power system minimizes the wiring, sensing, and control complexities required in a multi-sourced redundantly distributed power system. The single phase addresses only the distribution link; mulitphase lower frequency inputs and outputs accommodation techniques are described. While the 440 V operating potential was initially selected for aircraft operating below 50,000 ft, this potential also appears suitable for space power systems. This voltage choice recognizes a reasonable upper limit for semiconductor ratings, yet will direct synthesis of 220 V, 3 power. A 20 kHz operating frequency was selected to be above the range of audibility, minimize the weight of reactive components, yet allow the construction of single power stages of 25 to 30 kW. The regulated sinusoidal distribution system has several advantages. With a regulated voltage, most ac/dc conversions involve rather simple transformer rectifier applications. A sinusoidal distribution system, when used in conjunction with zero crossing switching, represents a minimal source of EMI. The present state of 20 kHz power technology includes computer controls of voltage and/or frequency, low inductance cable, current limiting circuit protection, bi-directional power flow, and motor/generator operating using standard induction machines. A status update and description of each of these items and their significance is presented. M.G.

N86-31585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION OPPORTUNITIES FOR THE 21ST CENTURY
William C. Strack 1986 32 p Presented at the Scenario for 21st Century Aero Engine Design Seminar, Bristol, England, 16-17 May 1986; sponsored by the Institute of Mechanical Engineers
(NASA-TM-88817; E-3177; NAS 1.15:88817) Avail: NTIS HC A03/MF A01 CSCL 21E

A large number of novel aeropropulsion system concepts are presented for subsonic through hypersonic applications offering large potential improvements. Collectively, these examples illustrate the revolutionary opportunities and challenges that could enable truly revolutionary aircraft capabilities in the future. Certainly not all of these concepts will ultimately prove fruitful. Nevertheless, the sheer number of existing concepts, including many unmentioned herein, is so large and the applications so vast, that the prognosis for the future of aeropropulsion is very encouraging indeed. Author

N86-31586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PARAMETRIC STUDY OF A GAS-GENERATOR AIRTURBO RAMJET (ATR)
Christopher A. Snyder 1986 19 p Presented at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; sponsored by AIAA, ASME, SAE and ASEE
(NASA-TM-88808; E-3156; NAS 1.15:88808) Avail: NTIS HC A02/MF A01 CSCL 21E

Parametric engine performance calculations were carried out for an airturbo ramjet (ATR). A LOX-LH2 rocket powered turbine powered the compressor. The engine was flown over a typical flight path up to Mach 5 to show the effect of engine off design operation. The compressor design efficiency, compressor pressure ratio, rocket turbine efficiency, rocket turbine inlet temperature, and rocket chamber pressure were varied to show their effect on engine net thrust and specific impulse at Mach 5 cruise. Estimates of engine weights as a fucntion of the ratio of compressor air to rocket propellant flow and rocket champer pressure are also included. In general, the Mach 5 results indicate that increasing the amount of rocket gas produced increased thrust but decreased the specific impulse. The engine performance was fairly sensitive to rocket chamber pressure, especially at higher compressor pressure ratios. At higher compressor pressure ratios, the engine thrust was sensitive to turbine inlet temperature. At all compressor pressure ratios, the engine performance was not sensitive to compressor or turbine efficiency. Author

N86-31587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OVERVIEW OF THE SMALL ENGINE COMPONENT TECHNOLOGY (SECT) STUDIES
M. R. Vanco, W. T. Wintucky, and R. W. Niedzwiecki Jun. 1986 20 p Presented at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; cosponsored by AIAA, ASME, SAE, and ASEE
(NASA-TM-88796; E-3131; NAS 1.15:88796; USAAVSCOM-TR-86-C-23; AIAA-86-1542) Avail: NTIS HC A02/MF A01 CSCL 21E

The objectives of the joint NASA/Army SECT Studies were to identify high payoff technologies for year 2000 small gas turbine engine applications and to provide a technology plan for guiding future research and technology efforts applicable to rotorcraft, commuter and general aviation aircraft and cruise missiles. Competitive contracts were awarded to Allison, AVCO Lycoming, Garrett, Teledyne CAE and Williams International. This paper presents an overview of the contractors' study efforts for the commuter, rotorcraft, cruise missile, and auxiliary power (APU) applications with engines in the 250 to 1,000 horsepower size range. Reference aircraft, missions and engines were selected. Advanced engine configurations and cycles with projected year 2000 component technologies were evaluated and compared with a reference engine selected by the contractor. For typical commuter and rotorcraft applications, fuel savings of 22 percent to 42 percent can be attained. For $1/gallon and $2/gallon fuel, reductions in direct operating cost range from 6 percent to 16 percent and from 11 percent to 17 percent respectively. For subsonic strategic cruise missile applications, fuel savings of 38 percent to 54 percent can be achieved which allows 35 percent to 60 percent increase in mission range and life cycle cost reductions of 40 percent to 56 percent. High payoff technologies have been identified for all applications. Author

N86-31588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBULENT DISPERSION OF THE ICING CLOUD FROM SPRAY NOZZLES USED IN ICING TUNNELS
C. John Marek and William A. Olsen, Jr. May 1986 17 p Presented at the 3rd International Workshop on Atmospheric Icing of Structures, Vancouver, British Columbia, 6-8 May 1986
(NASA-TM-87316; E-3047; NAS 1.15:87316) Avail: NTIS HC A02/MF A01 CSCL 21E

To correctly simulate flight in natural icing conditions, the turbulence in an icing simulator must be as low as possible. But some turbulence is required to mix the droplets from the spray nozzles and achieve an icing cloud of uniform liquid water content. The goal for any spray system is to obtain the widest possible spray cloud with the lowest possible turbulence in the test section

of a icing tunnel. This investigation reports the measurement of turbulence and the three-dimensional spread of the cloud from a single spray nozzle. The task was to determine how the air turbulence and cloud width are affected by spray bars of quite different drag coefficients, by changes in the turbulence upstream of the spray, the droplet size, and the atomizing air. An ice accretion grid, located 6.3 m downstream of the single spray nozzle, was used to measure cloud spread. Both the spray bar and the grid were located in the constant velocity test section. Three spray bar shapes were tested: the short blunt spray bar used in the NASA Lewis Icing Research Tunnel, a thin 14.6 cm chord airfoil, and a 53 cm chord NACA 0012 airfoil. At the low airspeed (56 km/hr) the ice accretion pattern was axisymmetric and was not affected by the shape of the spray bar. At the high airspeed (169 km/hr) the spread was 30 percent smaller than at the low airspeed. For the widest cloud the spray bars should be located as far upstream in the low velocity plenum of the icing tunnel. Good comparison is obtained between the cloud spread data and predicitons from a two-dimensional cloud mixing computer code using the two equation turbulence (k epsilon g) model. Author

N86-31589# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
NEW TECHNOLOGY PROPULSION (ANT) FOR GENERAL AVIATION AIRCRAFT, PHASE 1 Final Report, Aug. 1985
Ingo Borchers, Klaus Jonas, Rudolf Matecki, Hubert Krojer, Dieter Welte, and Herbert Zimmer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 158 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-031; ISSN-0170-1339; ESA-86-97472) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 32.50

The ANT concept for bimotor-turbopropelled aircraft developed from market-oriented requirements is characterized by two rear propellers and two engines installed inside the fuselage behind the passenger cabin, connected by transmission shafts. The concept is analyzed as regards aerodynamic quality, propeller installation efficiency, noise conditions and propeller load. The analysis is based on theoretical methods and wind tunnel tests with a 1:7 model. The propeller installation efficiency is improved by 10% to 14%. The specific range compared to that of an aircraft with conventional engine aircraft arrangement is increased by 15% and the maximum cruising speed by 7%. The noise level limit can be kept to 85 dB(A) and below. The dynamic behavior of the powerplant and noise should be further investigated. ESA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-31590*# Purdue Univ., West Lafayette, Ind. School of Aeronautics and Astronautics.
FLIGHT CONTROL SYNTHESIS FOR FLEXIBLE AIRCRAFT USING EIGENSPACE ASSIGNMENT
John B. Davidson and David K. Schmidt Jun. 1986 230 p
(Grant NAG1-254)
(NASA-CR-178164; NAS 1.26:178164) Avail: NTIS HC A11/MF A01 CSCL 01C

The use of eigenspace assignment techniques to synthesize flight control systems for flexible aircraft is explored. Eigenspace assignment techniques are used to achieve a specified desired eigenspace, chosen to yield desirable system impulse residue magnitudes for selected system responses. Two of these are investigated. The first directly determines constant measurement feedback gains that will yield a close-loop system eigenspace close to a desired eigenspace. The second technique selects quadratic weighting matrices in a linear quadratic control synthesis that will asymptotically yield the close-loop achievable eigenspace. Finally, the possibility of using either of these techniques with state estimation is explored. Application of the methods to synthesize integrated flight-control and structural-mode-control laws for a large flexible aircraft is demonstrated and results discussed. Eigenspace selection criteria based on design goals are discussed, and for the study case it would appear that a desirable eigenspace can be obtained. In addition, the importance of state-space selection is noted along with problems with reduced-order measurement feedback. Since the full-state control laws may be implemented with dynamic compensation (state estimation), the use of reduced-order measurement feedback is less desirable. This is especially true since no change in the transient response from the pilot's input results if state estimation is used appropriately. The potential is also noted for high actuator bandwidth requirements if the linear quadratic synthesis approach is utilized. Even with the actuator pole location selected, a problem with unmodeled modes is noted due to high bandwidth. Some suggestions for future research include investigating how to choose an eigenspace that will achieve certain desired dynamics and stability robustness, determining how the choice of measurements effects synthesis results, and exploring how the phase relationships between desired eigenvector elements effects the synthesis results. Author

N86-31591*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF A TAKEOFF PERFORMANCE MONITORING SYSTEM
Raghavachari Srivatsan (Kansas Univ., Lawrence), David R. Downing, and Wayne H. Bryant Aug. 1986 11 p Presented at the AIAA Guidance, Navigation and Control Conference, Williamsburg, Va., 18-20 Aug. 1986
(NASA-TM-89001; NAS 1.15:89001) Avail: NTIS HC A02/MF A01 CSCL 01C

The development and testing of a real-time takeoff performance monitoring system is discussed. The algorithm is madeup of two segments: a pretakeoff segment and a real-time segment. One-time inputs of ambient conditions and airplane configuration information are used in the pretakeoff segment to generate schedule performance data for that takeoff. The real-time segment uses the scheduled performance data generated in the pretakeoff segment, runway length data, and measured parameters to monitor the performance of the airplane throughout the takeoff roll. Airplane and engine performance deficiencies are detected and annunciated. An important feature of this algorithm is the one-time estimation of the runway rolling friction coefficient. The algorithm was tested using a six degree of freedom airplane model in a computer simulation. Results from a series of sensitivity analysis are also included. Author

N86-31592# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ON THE HANDLING QUALITIES OF FLIGHT VEHICLES THROUGH VARIABLE FLIGHT CONDITIONS M.S. Thesis
Kenneth C. Green Jan. 1986 100 p
(AD-A167727; AFIT/CI/NR-86-56T) Avail: NTIS HC A05/MF A01 CSCL 20/4

Specifications of flight vehicle handling qualities are currently based on the solution of linear, constant coefficient equations of motion, even when certain flight vehicles encounter continuously varing conditions in parts or all of their flight regime. This thesis develops an approach to encompass flight vehicle dynamics that vary during the performance of piloted tasks in the specification of handling qualities. Asymptotic methods, particularly Generalized Multiple Scales, are used to develop approximate analytical solutions to time-varying equations of motion. The solutions are valid throughout the time of variation, with constant flight conditions as a special case. Two classes of flight vehicles are examined to demonstrate the application of asymptotic methods to obtaining parameters pertinent to handling quality analyses. Extensions to existing criteria are suggested. This treatment of variable dynamics can give a clearer understanding of the response characteristics, and therefore of the stability and control requirements, of many piloted vehicles. GRA

N86-31593# European Space Agency, Paris (France).
ON CONTROL CONCEPT FOR IN-FLIGHT SIMULATION INCLUDING ACTUATOR NONLINEARITIES AND TIME DELAYS
Frohmut Hebschel Nov. 1985 67 p Original language document was announced as N86-10047
(ESA-TT-948; DFVLR-FB-85-24; ESA-86-97581) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 23.50

A model-following system was developed to study the dynamic behavior of transport aircraft with reduced longitudinal stability. The system is divided into two parts. The first consists of feedforward branches. If a linear description of the model and the basic aircraft is assumed an exact model-following is achieved by this part. For the control matrices algebraic expressions are derived. In the equations the influence of actuator dynamics is considered. A set of formulas in which all variables are assumed to be discretized for processing on a digital computer is developed. By the second subsystem an error suppression is achieved. The application of a cost vector method is demonstrated for one example. It is shown that nonlinearities and time lags can be included in the calculation of the feedback gains. ESA

N86-31596# Societe Nationale Industrielle Aerospatiale, Paris (France).
ANEMOBAROMETRY: AN ESSENTIAL ELEMENT OF FLIGHT CONTROL [L'ANEMOBAROMETRIE: ELEMENT ESSENTIEL DE LA CONDUITE DU VOL]
J. Bardou *In its* Anemobarometry in Flight Control. A-320 Aerodynamics. The Turboreactors Air Inlet 1985 3 p In FRENCH (For primary document see N86-31565 23-05)
Avail: NTIS HC A02/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-31594*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFOIL FLUTTER MODEL SUSPENSION SYSTEM Patent Application
Wilmer H. Reed, III, inventor (to NASA) (DEI-Tech, Inc., Newport News, Va.) Filed 30 Jul. 1986 14 p
(Contract NAS1-17686)
(NASA-Case-LAR-13522-1; US-Patent-Appl-SN-890575) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention is a wind tunnel suspension system for testing flutter models under various loads and at various angles of attack. The invention comprises a mounting bracket assembly affixing the suspension system to the wind tunnel, a drag-link assembly and a compound spring arrangement. The compound spring arrangement comprises a plunge spring working in opposition to a compressive spring so as to provide a high stiffness to trim out steady state loads and simultaneously a low stiffness to dynamic loads. By this arrangement an airfoil may be tested for oscillatory response in both plunge and pitch modes while being held under high lifting loads in a wind tunnel. NASA

N86-31595*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPERATING ENVELOPE CHARTS FOR THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC WIND TUNNEL
Rosemary A. Rallo, David A. Dress, and Henry J. A. Siegle Aug. 1986 23 p
(NASA-TM-89008; NAS 1.15:89008) Avail: NTIS HC A02/MF A01 CSCL 14B

To take full advantage of the unique Reynolds number capabilities of the 0.3-meter Transonic Cryogenic Tunnel (0.3-m TCT) at the NASA Langley Research Center, it was designed to accommodate test sections other than the original, octagonal, three-dimensional test section. A 20- by 60-cm two-dimensional test section was installed in 1976 and was extensively used, primarily for airfoil testing, through the fall of 1984. The tunnel was inactive during 1985 so that a new test section and improved high speed diffuser could be installed in the tunnel circuit. The new test section has solid adaptive top and bottom walls to reduce or eliminate wall interference for two-dimensional testing. The test section is 33- by 33-cm in cross section at the entrance and is 142 cm long. In the planning and running of past airfoil tests in the 0.3-m TCT, the use of operating envelope charts have proven very useful. These charts give the variation of total temperature and pressure with Mach number and Reynolds number. The operating total temperature range of the 0.3-m TCT is from about 78 K to 327 K with total pressures ranging from about 17.5 psia to 88 psia. This report presents the operating envelope charts for the 0.3-m TCT with the adaptive wall tes t section installed. They were all generated based on a 1-foot chord model. The Mach numbers vary from 0.1 to 0.95. Author

N86-31596# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
FIELD PERFORMANCE OF FIBER-REINFORCED CONCRETE AIRFIELD PAVEMENTS Final Report, Jan. 1983 - Jan. 1985
Raymond S. Rollings Jul. 1986 53 p
(Contract DTFA01-83-Y-30606)
(FAA/PM-86/26; WES-TR-GL-86-11) Avail: NTIS HC A04/MF A01

A field survey of steel fiber-reinforced concrete airfield pavements found the most serious performance problem to be permanent, early age curl of slabs and associated cracking. An examination of possible causes of this curl indicates it is probably due to the use of large slabs and thin sections. This study recommends slab sizes which should minimize this problem in the future. Other identified performance problems unique to this type pavement include loose surface fibers and nonfunctioning contraction joints. The design criteria for fiber-reinforced concrete were reviewed, and new criteria are proposed that are compatible with the Corps of Engineers change in portland cement concrete design criteria. A new method of overlay design was also proposed. Author

N86-31597# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION ON REDUCTION OF FLOW NOISE OF THE 0.6m X 0.6m TRISONIC WIND TUNNELS
Qilin Yun 28 Mar. 1986 25 p Transl. into ENGLISH from Kongqidonglixue Xuebao (China), no. 2, 1985 p 51-60 Original language document was announced in IAA as A85-38968
(AD-A166302; FTD-ID(RS)T-0034-86) Avail: NTIS HC A02/MF A01 CSCL 20/1

A significant reduction of the tunnel flow noise was achieved and the noise level has been among the lowest of the intermittent wind tunnels both at home and abroad by adding a noise-reducing device after the pressure regulating valve. Mounting screens on the perforated walls in the test section permitted further reduction of the flow noise in the section. It has been shown however, that the screen-mounting technique on the walls needs to be improved. GRA

N86-31598# Naval Postgraduate School, Monterey, Calif.
DESIGN OF A VERTICAL THRUST STAND FOR A REMOTELY PILOTED MODEL HELICOPTER M.S. Thesis
Theodore J. Urda Mar. 1986 42 p
(AD-A167811) Avail: NTIS HC A03/MF A01 CSCL 14/2

This paper discusses the necessary functional characteristics for the design of a test stand to measure the vertical thrust of a remotely piloted model helicopter as a function of power output, in different degrees of ground effect. A number of potential design choices are presented along with possible instrumentation schemes to obtain both the power output and the lifting force generated by

the Heli-Star model helicopter equipped with a Gold Cup HP.61 engine. Included are the results of preliminary validation testing of the test stand design chosen and a discussion of the methods used to eliminate or control vibrations which hampered the utility of the test stand. Recommendations for possible future modifications are also included. GRA

N86-31599# Naval Postgraduate School, Monterey, Calif.
APPLICATIONS OF INFRARED THERMOGRAPHY IN CONVECTIVE HEAT TRANSFER M.S. Thesis
Timothy M. Spence Mar. 1986 69 p
(AD-A167872) Avail: NTIS HC A04/MF A01 CSCL 21/5

A full-scale model of a double-wedge, simulating a jet vane used in guided-missile thrust vector control (TVC), was constructed for subsonic wind tunnel testing to evaluate the feasibility of using a thermal imaging (infrared) system vice thermocouples to determine a surface heat transfer coefficient. The model was preheated, then allowed to cool via forced convection to ambient conditions. Surface temperature readings were taken using thermocouples and a thermal imaging system during the cooldown process. These readings were then reduced to solve for a heat transfer coefficient (h), using Newton's Law of Cooling. The results were compared with the theoretical solution for a flat plate and with the results obtained by testing an actual TVC vane configuration under the identical flow conditions. GRA

N86-31600# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A VISIT TO CHINA'S FIRST DOMESTIC MADE FIGHTER FLIGHT SIMULATOR
Xin Ri 6 May 1986 5 p Transl. into ENGLISH from Hangkong Zhishi (China), no. 1, 1984 p 4-5
(AD-A167898; FTD-ID(RS)T-0884-85) Avail: NTIS HC A02/MF A01 CSCL 05/9

China's first domestic made fighter flight simulator underwent official state evaluation and was put into service with the Air Force. The flight simulator is made up primarily of three components: the computer room, the fuselage room and the scenery viewing room; the movable simulator cockpit; and the scenery system. The fuselage room is center stage of the entire simulator. The drill and instruction of flight students and the flight training of aircrews is all done here. GRA

N86-31601# Dayton Univ., Ohio. Research Inst.
AIRCREW TRAINING DEVICES: UTILITY AND UTILIZATION OF ADVANCED INSTRUCTIONAL FEATURES. PHASE III: ELECTRONIC WARFARE TRAINERS Final Report, May - Sep. 1984
Donald J. Polzella and David C. Hubbard Apr. 1986 71 p
(Contract F33615-81-C-0005)
(AD-A167922; AFHRL-TR-85-49) Avail: NTIS HC A04/MF A01 CSCL 05/9

An aircrew training device (ATD) is not merely a flight simulator. It is also equipped with sophisticated hardware and software capabilities, known as advanced instructional features (AIFs), that permit a simulator instructor to control, monitor and fabricate simulator training missions. This report describes the third phase of a three-phase project designed to determine the utility and utilization of AIFs by means of a survey of simulator instructors from the Air Force Major Commands. Phase I surveyed 134 instructor pilots and weapons director instructors assigned to principal Tactical Air Command (TAC) ATD training sites. Phase II surveyed 273 instructor pilots, flight engineers, and radar/navigators from Air Training Command (ATC), Military Airlift Command (MAC), and Strategic Air Command (SAC). Phase III extended the survey to 155 electronic warfare and aerial gunnery instructors from ATC, SAC, and TAC training facilities. Based on utility and utilization ratings, the T-5 and T-4 trainers were the most favorably evaluated devices surveyed. They were followed, in order, by the F-4G simulator, B-52 weapon system trainer, and A-10 simulator. The level of AIF use was affected somewhat by hardware and software unreliability, implementation time, functional limitations, and design deficiencies. GRA

N86-31602# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
AIRPORT NOISE CONTROL STRATEGIES
Patricia A. Cline May 1986 126 p
(AD-A167977; FAA-EE-86-02) Avail: NTIS HC A07/MF A01 CSCL 20/1

The Federal Aviation Administration's (FAA) Airport Noise Control Strategies Data File contains a comprehensive listing of airport noise control actions. The information contained in this data file is an updated version of the June 1983 Airport Noise Control Strategies report. Originally, the data were collected from the Environmental Data Bank of March 1979, the National Business Aircraft Association and the Aircraft Operators Council International. Additional data were garnered from the FAA Airport Facility Directory. For this version, the FAA regional offices reviewed the latest information and made appropriate changes. Thirty-seven categories of noise control actions have been identified and are in use, singly or in combination, by approximately 400 airports. GRA

N86-31603# Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Warmte- en Stromingsleer.
QUALITY DETERMINATION OF THE HEAT AND FLOW THEORY DEPARTMENT (WS) SUBSONIC WIND TUNNEL AND EXPERIMENTS USING LASER DOPPLER VELOCITY MEASUREMENT Ph.D. Thesis [KWALITEITSBEPALING VAN DE WS SUBSONE WINDTUNNEL EN EXPERIMENTEN HIERIN MET LASER-DOPPLER SNELHEIDSMETING]
Hans vanWolferen Jul. 1984 97 p In DUTCH
(ESA-86-97355) Avail: NTIS HC A05/MF A01

Wind tunnel characteristics, i.e., the static pressure distribution along the tunnel axis, ventilator characteristics, and quality of the measurement section determined by the velocity distribution and turbulence level, were investigated using pressure and hot-wire velocity measurements. The utility of laser Doppler anemometers (LDA) in the tunnel was examined using a two-beam and real-fringe formation. The photomultiplier detector signal was processed with a digital autocorrelator. The best formation for an optimal correlation function was determined. Autocorrelation processing of velocity and turbulence was performed. The spectral density of the LDA signal was determined from the autocorrelation function with the maximum entropy method. The spectral analysis was tested with test signals and the LDA results in the wake of a cylinder at a Reynolds number of 15,000 to 45,000. ESA

N86-31604# VDO-Luftfahrtgeraete Werk Adolf Schindling G.m. b.H., Frankfurt (West Germany). Bereich Luftfahrt.
STUDIES FOR THE APPLICATION OF A FLEXIBLE WEIGHT AND BALANCE (W/B) MEASURING FACILITY FOR COMMERCIAL AIRCRAFT Final Report, Jun. 1984
Hans Werner Fischer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 73 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-029; ISSN-0170-1339; ESA-86-97471) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15.50

A weight and balance measuring facility incorporating shear stress sensors was developed and studied as regards accuracy, stability and applicability. The sensor system measures shear stress on the landing gear frame or on the nose landing gear tire axis. The construction, efficiency, maneuverability, and interfaces on the shear stress system are described. The causes of hysteresis in the measuring systems at the nose landing gear are experimentally investigated. The facility can be applied to series measurement. ESA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-31605 Ecole Polytechnique, Palaiseau (France).
SPACE AND DEFENSE [ESPACE ET DEFENSE]

5 Dec. 1985 29 p In FRENCH Presented at Journee Nationale Science et Defense, Palaiseau, France, 5 Dec. 1985 Prepared in cooperation with Direction des Recherches Etudes et Techniques (ESA-86-97272) Avail: Issuing Activity

The problems of detecting and destroying missiles using satellites with energy weapons are discussed. The analysis of the satellite system shows that a large number of satellites (over 100) are necessary to assure the simultaneous presence of 5 satellites over the region to be defended. The minimum time requirement for the development of such a strategic defense system is 25 yr. The potentials of several types of weapons are examined, showing that the most promising system is a chemical laser in the infrared. Such a laser could be developed in 10 yr to produce megawatts of continuous energy with an effective range of 1500 km. It is concluded that because of the severe development problems and the basic nature of the system itself it is quite probable that complete protection cannot be assured. ESA

N86-31606*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF SOLAR ARRAY FLIGHT EXPERIMENT RESPONSE DURING FLIGHT FOR EXTENSION/RETRACTION PHASE
Jerry Slaby Jun. 1986 17 p
(NASA-TM-86551; NAS 1.15:86551) Avail: NTIS HC A02/MF A01 CSCL 22A

This post flight evaluation of the Solar Array Flight Experiment's (SAFE) deployment dynamics explains the encountered resonances. Author

N86-31607# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FEASIBILITY STUDY OF SURVEILLANCE AVOIDANCE DURING THE DEPLOYMENT OF SOVIET PAYLOADS OF MILITARY INTEREST INTO ORBIT FROM A SOVIET SHUTTLE M.S. Thesis
Edward F. Faudree, Jr. Dec. 1985 85 p
(AD-A167661; AFIT/GSO/ENS/85D-9) Avail: NTIS HC A05/MF A01 CSCL 17/9

The purpose of this thesis was to start a line of inquiry into how well the North American Aerospace Defense Command's (NORAD) radars can detect a satellite deployment from a Soviet space shuttle, one that is comparable to the U.S. space shuttle in size and capability. The radar locations and capabilities were assumed to be the ones presently operating plus a new PAVE PAWS radar in Texas and a new mechanical tracker on the island of Saipan. All radars were assumed to be in working order, and tracking the shuttle. The shuttle was assumed to be launched in a 51.62 deg. inclination, and would attempt deployment only at an ascending or descending node. The satellite could move away from the shuttle along the shuttle's radius vector, velocity vector, or angular momentum vector, so that it is approximately 50 kilometers from the shuttle one half an orbital revolution later. The geocentric angular separation, absolute distance apart and range difference is calculated when the pair are closest to the radar. The elevation angle above the radar's horizon is estimated, and assuming the worst-cas e viewing geometry of the shuttle and satellite by the radar site, a topocentric range difference and angular separation are determined. These values of angle and distance are compared to that particular radar's capabilities. GRA

N86-31608# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
THE USE OF MANNED SPACE FLIGHT [NUTZEN DER BEMANNTEN RAUMFAHRT]
Ruediger Scheunemann and Hans-Leo Richter Oct. 1985 20 p In GERMAN Original contains color illustrations
(ESA-86-97412) Avail: NTIS HC A02/MF A01

The use and the future applications of manned space flight research results are discussed. Scientific experiments in Spacelab and the possible utilization of the results for research and industry on Earth are described. The effects of weightlessness on materials research and the production of new materials; the production in space of GaAs crystals for microelectronics and superchips; turbine blades made of single crystals; the production of large biological single crystals; biology in space; living cells under conditions of weightlessness; medical experiments on astronauts; space sickness; investigations of the vestibular apparatus; and the TEXUS-program are treated. ESA

N86-31609# Technische Hochschule, Aachen (West Germany). Inst. fuer Physikalische Chemie.
INTERDIFFUSION IN BINARY SALT MELTING UNDER WEIGHTLESSNESS Final Report, Jan. 1984
Juergen Hermanns, Achim Hahne, Wilhelm Merkens, and Joachim Richter Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1985 106 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-017; ISSN-0170-1339; ESA-86-97461) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.50

A laboratory facility based on the plane source method was used to measure interdiffusion coefficients of binary alkaline and silver nitrate melts depending on the concentration at 300C using an interpolation interferometer. The applicability of the flowing junction cell under reduced gravity is demonstrated. Gas bubbles resulting from the reaction of the melt with the sealing material show a laminar flow in the measuring cell. After venting of the cell through a large gas bubble the melt forms a tight boundary. The flowing junction cell facility was improved to increase its operating reliability and to reduce the test duration. The concentration difference between melts can be reduced to 1 mole % through hydrodynamic boundary production to increase measurement accuracy. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-31610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDY OF A HOMOTOPY CONTINUATION METHOD FOR EARLY ORBIT DETERMINATION WITH THE TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS)
R. L. Smith (Computer Sciences Corp., Beltsville, Md.) and C. Huang Washington Mar. 1986 140 p
(NASA-TM-86230; NAS 1.15:86230) Avail: NTIS HC A07/MF A01 CSCL 22B

A recent mathematical technique for solving systems of equations is applied in a very general way to the orbit determination problem. The study of this technique, the homotopy continuation method, was motivated by the possible need to perform early orbit determination with the Tracking and Data Relay Satellite System (TDRSS), using range and Doppler tracking alone. Basically, a set of six tracking observations is continuously transformed from a set with known solution to the given set of observations with unknown solutions, and the corresponding orbit state vector is followed from the a priori estimate to the solutions. A numerical algorithm for following the state vector is developed and described in detail. Numerical examples using both real and simulated TDRSS tracking are given. A prototype early orbit determination algorithm for possible use in TDRSS orbit operations was extensively tested, and the results are described. Preliminary studies of two extensions of the method are discussed: generalization to a least-squares formulation and generalization to an exhaustive global method. Author

N86-31611# Sandia National Labs., Albuquerque, N. Mex.
POINT-MASS SIMULATION TOOL (PMAST) USER'S MANUAL
D. E. Salguero Mar. 1986 181 p

(Contract DE-AC04-76DP-00789)
(DE86-009547; SAND-85-2039) Avail: NTIS HC A09/MF A01

The Point-Mass Simulation Tool (PMAST) is designed to meet the need for a comprehensive conceptual-level trajectory analysis tool that is easy to use. Three degree-of-freedom equations of motion that simulate the flight vehicle as a point mass are used to compute the trajectories. Guidance commands input by the user control the vehicle so that it performs the desired maneuvers. During the development of PMAST, special attention was given to the input and output data formats in an effort to make the code easy to use. This manual describes the format of the input and output data files, and it shows how to execute the program on both the VAX and CRAY computer systems. DOE

N86-31612# Hatfield Polytechnic (England). Numerical Optimization Center.
START SOLUTION FOR INTERPLANETARY LOW THRUST TRAJECTORY OPTIMIZATION AND MODEL REFINEMENT, VOLUME 1
L. C. W. Dixon, S. E. Hersom, Z. A. Maany, and K. D. Patel Paris, France ESA Feb. 1985 119 p
(Contract ESA-4774/81-D-JS(SC))
(ESA-CR(P)-2175-Vol-1; ESA-86-97490-Vol-1) Avail: NTIS HC A06/MF A01

A robust method of starting the optimization of satellite orbits, typically between the Earth and an asteroid when the satellite is powered by a low thrust RTG or solar power unit is presented. The original software located an approximation to an optimal orbit, if started within a certain region of attraction of that orbit (in the space of the optimization variables). An automatic method of locating such a starting point and a method for refining the solution were developed. ESA

N86-31613# Hatfield Polytechnic (England). Numerical Optimization Center.
START SOLUTION FOR INTERPLANETARY LOW THRUST TRAJECTORY OPTIMISATION AND MODEL REFINEMENT. VOLUME 2: USER'S GUIDE TO THE SOFTWARE FOR LOW THRUST ORBIT OPTIMIZATION FOR INTERPLANETARY MISSIONS USING A LINEAR MODEL
S. E. Hersom, Z. A. Maany, and K. D. Patel Paris, France ESA Nov. 1984 66 p
(Contract ESA-4774/81-D-JS(SC))
(ESA-CR(P)-2175-Vol-2; ESA-86-97491-Vol-2) Avail: NTIS HC A04/MF A01

A user guide for a low thrust orbit control problem is presented. ESA

N86-31614# Hatfield Polytechnic (England). Numerical Optimization Center.
START SOLUTION FOR INTERPLANETARY LOW THRUST TRAJECTORY OPTIMIZATION AND MODEL REFINEMENT. VOLUME 3: LOW THRUST ORBIT OPTIMIZATION FOR INTERPLANETARY MISSIONS USING A PONTRYAGIN/LAMBERT APPROACH
S. E. Hersom and Z. A. Maany Paris, France ESA Mar. 1985 113 p
(Contract ESA-4774/81-D-JS(SC))
(ESA-CR(P)-2175-Vol-3; ESA-86-97492-Vol-3) Avail: NTIS HC A06/MF A01

Descriptions are given of the package written for the European Space Operations center for low thrust orbit control problem solving. ESA

N86-31615# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
PROBLEMS OF ARCADE-3 SATELLITE ATTITUDE DETERMINATION
J. C. Kosik 29 May 1984 96 p In FRENCH; ENGLISH summary
(CNES-CT/DTI/MS/CD/122; ESA-86-97649) Avail: NTIS HC A05/MF A01

Due to partial failure of the infrared Earth sensor, the attitude of ARCADE-3 satellite in a polar orbit was calculated using magnetometer and Sun sensor data. The origins of a lower precision in attitude calculation are examined, including instrument bias, spacecraft magnetic noise, and the polar orbit. A correction function by which the attitude error is reduced by half is described. The importance of the infrared Earth sensor in determining accurate attitudes is discussed. ESA

N86-31616# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
THEMATIC CLASSIFICATION OF ANALYTIC MODELS FOR ORBIT PREDICTION, VOLUME 1
J. C. Agnese 17 Oct. 1984 31 p In FRENCH; ENGLISH summary
(CNES-CT/DTI/MS/MN/240-Vol-1; ESA-86-97654-Vol-1) Avail: NTIS HC A03/MF A01

Orbit calculation mathematical models were classified by orbit type, such as circular, equatorial, or transfer orbits. Perturbations are also used as classification labels, including Earth potential, atmospheric drag, solar wind and radiation pressure. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-31617*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
MODELING DIRECTIONAL SOLIDIFICATION FURNACES Final Technical Report
James E. Smith, Jr. and Gerald R. Karr Aug. 1986 53 p
(Grant NAG8-553)
(NASA-CR-177148; NAS 1.26:177148) Avail: NTIS HC A04/MF A01 CSCL 14B

Theoretical considerations on the axial and radial temperature profiles are examined to serve as a guide to the furnace designer. Analytical and numerical studies were performed and the results were summarized. B.G.

N86-31618# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF THE CENTAUR GROUND PROCESSING SYSTEM AT THE KENNEDY SPACE CENTER/CAPE CANAVERAL AFS M.S. Thesis
John T. Brock Dec. 1985 299 p
(AD-A167123; AFIT/GSO/ENS/85D-3) Avail: NTIS HC A13/MF A01 CSCL 16/1

This project determined the capability and limitations of the new Shuttle/Centaur ground processing system at the Kennedy Space Center/Cape Canaveral AFS FL. In particular, it investigates whether or not the system could process four Centaur vehicles in a one year period. To determine the system's capability two tools were developed: a PERT network graph and a SLAM simulation model of the system. The output from these two sources formed the basis for the analysis of the system. The PERT network was constructed using data from the Centaur Program Office and from Cape Canaveral AFS FL. The critical path through the network was also identified. Analysis of the PERT network indicated that it will take over 230 days to process one Centaur vehicle and that there is no slack time in the processing schedule. The SLAM model was built for the proposed system and simulation runs were conducted using versions of the processing system with modified elements, i.e., increased facilities. These runs indicated that additional resources must be procured if the system is to reach four flight per year processing rate. As currently configured, the system can support only two flights a year. GRA

N86-31619# Materials Research Labs., Ascot Vale (Australia).
RAIL INDUCTANCE CALCULATIONS FOR SOME SIMPLE CURRENT DISTRIBUTIONS
V. Kowalenko Feb. 1986 44 p
(AD-A167915; MRL-R-976) Avail: NTIS HC A03/MF A01 CSCL 20/3

In this study, an expression for the inductance per unit length of the rails for a railgun-type electromagnetic launcher (EML) is derived from first principles using simple quasi-stationary models for the current distribution in the rails. The results are applied in particular, to the MRL railgun and are compared with work by others in the field. The study concludes with discussions on the problems associated with current diffusion in the rails, and the resulting influence upon the equation-of-motion used in evaluating projectile performance. Author (GRA)

N86-31620# Los Alamos National Lab., N. Mex.
ELECTROMAGNETIC RAILGUN AND ITS APPLICATIONS
S. Jinhua and J. Hao 1986 19 p Transl. into ENGLISH from Pao Cha Yu Chung-Chi (Communist China), v. 4, no. 2, 1984 p 90-96
(Contract W-7405-eng-36)
(DE86-009487; LA-tr-86-15) Avail: NTIS HC A02/MF A01

This paper briefly introduces the research history and current state of research of the electromagnetic railgun, describes its basic structure and energy systems, and notes fundamental research into several possible applications, including military and atmospheric firings. DOE

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-31621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CENTAUR ENGINE GIMBAL FRICTION CHARACTERISTICS UNDER SIMULATED THRUST LOAD
James W. Askew Sep. 1986 21 p
(NASA-TM-87335; E-3080; NAS 1.15:87335) Avail: NTIS HC A02/MF A01 CSCL 20H

An investigation was performed to determine the friction characteristics of the engine gimbal system of the Centaur upper stage rocket. Because the Centaur requires low-gain autopilots in order to meet all stability requirements for some configurations, control performance (response to transients and limit-cycle amplitudes) depends highly on these friction characteristics. Forces required to rotate the Centaur engine gimbal system were measured under a simulated thrust load of 66,723 N (15,000 lb) and in an altitude/thermal environment. A series of tests was performed at three test conditions; ambient temperature and pressure, ambient temperature and vacuum, and cryogenic temperature and vacuum. Gimbal rotation was controlled, and tests were performed in which rotation amplitude and frequency were varied by using triangular and sinusoidal waveforms. Test data revealed an elastic characteristic of the gimbal, independent of the input signal, which was evident prior to true gimbal sliding. The torque required to initiate gimbal sliding was found to decrease when both pressure and temperature decreased. Results from the low amplitude and low frequency data are currently being used in mathematically modeling the gimbal friction characteristics for Centaur autopilot performance studies. M.G.

N86-31622# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
DEVELOPMENT OF FLIGHT CONTROL SYSTEMS FOR MANEUVERABLE MISSILE WEAPON SYSTEMS. EXAMPLE OF OPERATION ORGANIZATION [ENTWICKLUNG VON FLUGFUEHRUNGSSYSTEMEN FUER LENKFLUGKOERPERWAFFENSYSTEME. EIN BEISPIEL EINER BEARBEITUNGSORGANISATION]
Werner Bub 14 Oct. 1985 18 p In GERMAN
(MBB-UA-929/85; ESA-86-97480) Avail: NTIS HC A02/MF A01

The organization of the development of flight control systems for maneuverable missiles is discussed. The basic functions of a flight control system are explained. The working domains of the different divisions taking part in the development are described. These divisions are control and systems theory, control and systems technique, control and steering electronics, computer aided systems, flight control software, simulation and computer technique, and the main division control and simulation. ESA

N86-31623# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
STUDY OF THE FIXATION OF HERMES VEHICLE ON THE ARIANE 5 LAUNCH VEHICLE [ETUDE DE L'ACCROCHAGE DU VEHICULE HERMES SUR LE LANCEUR ARIANE 5]
M. Agrain 1986 7 p In FRENCH Presented at CNES Struct. des Vehicules Spatiaux, Toulouse, 2-4 Dec. 1985
(SNIAS-861-422-121; ESA-86-97606) Avail: NTIS HC A02/MF A01

The preliminary design of an Ariane-Hermes adaptor is discussed. The cross section transition from Hermes shape to circular is made around the Hermes body and the design provides for aerodynamic requirements. Fixation methods are discussed. ESA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-31624# Air Command and Staff Coll., Maxwell AFB, Ala.
STS (SPACE TRANSPORTATION SYSTEM) EXPERIMENT SUPPORT STRUCTURE NEEDS ASSESSMENT
Wallace A. Beauchamp Apr. 1986 42 p
(AD-A167859; ACSC-86-0230) Avail: NTIS HC A03/MF A01 CSCL 22/1

The DOD space-based research and development program has a growing dependence on the Space Transportation System (STS). A shortfall in STS experiment support structures impedes the flight of the DOD payloads. This study looks at the existing support system from a management perspective in order to develop a procurement strategy for additional experiment support structures. The study concludes that a major problem is the existing NASA manifesting system. It recommends procurement of a flexible support structure and increased inventories of NASA sponsored carriers. The increased support includes funding for additional hardware and manpower for NASA. Author (GRA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-31625*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACTS EXPERIMENTS PROGRAM
Ronald J. Schertler 1986 12 p Proposed for presentation at Globecom '86, Houston, Tex., 1-4 Dec. 1986; sponsored by the Institute of Electrical and Electronics Engineers
(NASA-TM-88820; E-3182; NAS 1.15:88820) Avail: NTIS HC A02/MF A01 CSCL 17B

An overview of the ACTS Experiments Program is presented.

ACTS is being developed and will flight test the advanced technologies associated with: a Ka-band multibeam antenna, onboard signal processing and switching as well as laser communications. A nominal 3 yr experiments-program is planned. Through the experiments program, the capabilities of the ACTS system will be made available to U.S. industry, university and government experimenters to test, prove the feasibility and evaluate the key ACTS system technologies. Communication modes of operation using the baseband processor and microwave switch matrix are presented, along with the antenna coverage pattern. Potential experiment categories are also presented and briefly discussed. An overall schedule of activities associated with the experiments program is outlined. Results of the ACTS Experiments Program will provide information vital to successful industry implementation of ACTS technology in a future operational system. Author

N86-31626# Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRY SYSTEM FOR VERY HIGH ACCELERATION [SYSTEME DE TELEMESURE POUR PROJECTILES SOUMIS A DE TRES FORTES ACCELERATIONS]
Ph. Rateau 1 Jul. 1985 17 p In FRENCH Presented at 1st Journee Internationale des Telemesures of the 36th Salon International de l'Aeronautique et de l'Espace, Bourget, France, 1985
(ISL-CO-214/85; ESA-86-97626) Avail: NTIS HC A02/MF A01

Hybrid radio transmission electronic modules designed for telemetry utilization and inclusion in gun projectiles are described. The dimensions of each module are 10 x 10 x 2 mm and they can be used in projectiles with a minimum of 20 mm diameter. The effective transmission trajectory range varies from 1 km for 30 mm projectiles to 30 km for heavy artillery projectiles. A large variety of measurements are possible including ballistic, aerodynamic, mechanical, and physical parameters. The circuits of several modules are detailed. ESA

N86-31627# Societe Nationale Industrielle Aerospatiale, Paris (France).
NUMERICAL FUSION OF REDUNDANT TELEMETRY SOURCES
F. Pellet 1986 9 p Presented at ITC 85 Conference on Transition to Space Based Instrumentation System: Preparing for the Challenge of the 80's, Las Vegas, Nev., 28-31 Oct. 1985
(SNIAS-861-422-113; ESA-86-97600) Avail: NTIS HC A02/MF A01

A method to obtain delayed information about all on-board emitted data during the flight test of a missile or a launcher is presented. A deferred restitution of data transmitted at 1 Mbit/sec during several minutes is obtained up to 1 bit using the redundancies in recording information sources. The method allows a complete analysis of the way the vehicle systems work and gives useful knowledge on the contribution of each station, signal quality, error transmission, and the usefulness of each redundancy. ESA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N86-31628 National Aerospace Lab., Amsterdam (Netherlands). Space Div.
SOLICITED PROPOSAL FOR A NAVSAT CONTROL SEGMENT HARMONIZATION STUDY
O. B. M. Pietersen, J. Ryan, and F. Visser 1985 41 p
(NLR-Memo-RS-85-020-L; ESA-86-97781) Avail: Issuing Activity

A proposal to harmonize two studies on the Navsat Control Segment, carried out by Racal-Decca Advanced Development Ltd, under ESA contract number 5501/83/F/RD(SC), with a subcontract to Delft University of Technology, is made. The two studies diverge quite considerably because of differences in the baseline system concept, different emphases and different decisions taken for technical solutions. It is believed that discrepancies can be harmonized by discussions between NLR and Racal-Decca, while recommendations can be given to solve remaining differences. ESA

N86-31629 Centre National d'Etudes Spatiales, Toulouse (France).
DESIGN OF SPACECRAFT
Daniel Marty and Frederic dAllest 1986 669 p In FRENCH; ENGLISH summary
(ISBN-2-225-80732-9; ESA-86-97643) Copyright. Avail: CEPADUES, Toulouse, France

Satellite orbit calculation, orbit perturbations, structural design, thermal control, satellite tests, interplanetary vehicles, conventional launchers, space shuttles, avionics, propulsion, stability and optimization are covered in this textbook. ESA

N86-31630*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELOADED SPACE STRUCTURAL COUPLING JOINTS Patent Application
Marvin D. Rhodes, inventor (to NASA) Filed 30 Jul. 1986 16 p
(NASA-Case-LAR-13489-1; US-Patent-Appl-SN-890445) Avail: NTIS HC A02/MF A01 CSCL 22B

This invention relates to a coupling device for tubular members, of large truss structures, with a locking collar being the only moving part. Each tubular member is constructed with an end bell section that has a belled flange with a mating face, and a necked area which is smaller in diameter than the tubular members to be joined. A split ring is affixed to each tubular member and is constructed so that when two tubular members are laterally moved into axial alignment and the collar is rotated thereover, the split ring loads the joint with axial force by pressing the belled flange mating surfaces together, and a preloading force is provided by the collar mating with a taper on the outside of the split rings. All free play is thereby removed by preloaded force. A major object of the invention is to provide an ability to remove and replace individual tubular members without disturbing other structural parts of a truss structure. An additional anticipated use of this joint is to couple high pressure fluid lines. NASA

N86-31631*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE INVESTIGATION OF TETHERED SATELLITE SYSTEM DYNAMICS Quarterly Report, 15 Feb. - 14 May 1986
Enrico C. Lorenzini Jun. 1986 113 p
(NASA-CR-178895; NAS 1.26:178895; QR-7) Avail: NTIS HC A06/MF A01 CSCL 22B

The analysis of the rotational dynamics of the satellite was focused on the rotational amplitude increase of the satellite, with respect to the tether, during retrieval. The dependence of the rotational amplitude upon the tether tension variation to the power 1/4 was thoroughly investigated. The damping of rotational oscillations achievable by reel control was also quantified while an alternative solution that makes use of a lever arm attached with a universal joint to the satellite was proposed. Comparison simulations between the Smithsonian Astrophysical Observatory and the Martin Marietta (MMA) computer code of reteival maneuvers were also carried out. The agreement between the two, completely independent, codes was extremely close, demonstrating the reliability of the models. The slack tether dynamics during reel jams was analytically investigated in order to identify the limits of applicability of the SLACK3 computer code to this particular case. Test runs with SLACK3 were also carried out. Author

N86-31632*# Ball Aerospace Systems Div., Boulder, Colo.
PHASE 3 STUDY OF SELECTED TETHER APPLICATIONS IN

SPACE, MID-TERM REVIEW
10 Jul. 1986 67 p
(Contract NAS8-36617)
(NASA-CR-178900; NAS 1.26:178900; DPD-665; DR-3) Avail: NTIS HC A04/MF A01 CSCL 22B

Topics addressed include: guidelines for the Space Transportation System (STS) payload deployer design; mini-orbital maneuvering vehicle (MOMV) design: shuttle tether deployer systems (STEDS); cost modeling; tethered platform analysis; fuel savings analysis; and STEDS control simulation. B.G.

N86-31633*# National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH NOAA-G WEATHER SATELLITE
Jim Kukowski, Bud Littin, and Jim Elliott 19 Aug. 1986 11 p
(NASA-TM-89245; NASA-News-Release-86-115; P86-10175; NAS 1.15:89245) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

A meteorological weather satellite, NOAA-G, is scheduled to be launched from Vandenberg Air Force Base, Calif., aboard a U.S. Air Force Atlas-E launch vehicle, no earlier than 11:47 a.m., EDT, August 30. The satellite, a third-generation operational weather satellite, will be placed into a near-polar orbit at an altitude of 518 miles. The spacecraft, NOAA-10 in orbit, will circle the globe 14 times each day observing a different position of the Earth's surface on each revolution as the Earth turns beneath the spacecraft's orbit. It will become the morning satellite, joining NOAA-9, in NOAA's two polar orbit satellite system. The satellite's orbital period will be approximately 101 minutes. The orbit is planned to be Sun synchronous so that the spacecraft will cross the equator at approximately 7:30 a.m. (southbound) and 7.30 p.m. (northbound), local solar time. Like other NOAA satellites, NOAA-G will collect meteorological data and transmit the information directly to users around the world to enhance local weather analysis and forecasting. In addition to assisting in local weather forecasting, the satellite data are used for hurricane tracking and warning, and for agricultural, commercial fishing, forestry, maritime and other industrial uses. Author

N86-31634*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF AN OXYGEN PLASMA ON THE PHYSICAL AND CHEMICAL PROPERTIES OF SEVERAL FLUIDS FOR THE LIQUID DROPLET RADIATOR
Daniel A. Gulino and Carolyn E. Coles 1986 12 p Proposed for presentation at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by the American Institute of Aeronautics and Astronautics
(NASA-TM-88839; E-3222; NAS 1.15:88839) Avail: NTIS HC A02/MF A01 CSCL 07D

The Liquid Droplet Radiator is one of several radiator systems currently under investigation by NASA Lewis Research Center. It involves the direct exposure of the radiator working fluid to the space environment. An area of concern is the potential harmful effects of the low-Earth-orbit atomic oxygen environment on the radiator working fluid. To address this issue, seven candidate fluids were exposed to an oxygen plasma environment in a laboratory plasma asher. The fluids studied included Dow Corning 705 Diffusion Pump Fluid, polymethylphenylsiloxane and polydimethlsiloxane, both of which are experimental fluids made by Dow Corning, Fomblin Z25, made by Montedison, and three fluids from the Krytox family of fluids, Krytox 143AB, 1502, and 16256, which are made by DuPont. The fluids were characterized by noting changes in visual appearance, physical state, mass, and infrared spectra. Of the fluids tested, the Fomblin and the three Krytoxes were the least affected by the oxygen plasma. The only effect noted was a change in mass, which was most likely due to an oxygen-catalyzed deploymerization of the fluid molecule. Author

N86-31635# Societe Nationale Industrielle Aerospatiale, Cannes (France).
THERMAL CONTROL IN TELECOMMUNICATION AND DIRECT TELEVISION SATELLITES [LA THERMIQUE DANS LES SATELLITES DE TELECOMMUNICATIONS ET DE TELEVISION DIRECTE]
Charles Carton 1986 17 p In FRENCH Presented at Rencontre SFT 1985
(SNIAS-861-440-102; ESA-86-97611) Avail: NTIS HC A02/MF A01

The solutions adopted to obtain thermal equilibrium in geostationary satellites such as TDF, TV SAT, TELE-X and Arabsat are reviewed. Passive and active temperature control devices are described, including heat pipe systems, insulators, radiation reflectors and electrical heating. It is shown that the design of a satellite is strongly determined by thermal equilibrium considerations. ESA

N86-31636# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
ATTITUDE CONTROL OF SPACECRAFT: AN OVERVIEW OF RECENT DEVELOPMENTS AND RESEARCH
T. Zwartbol 27 Jun. 1985 24 p In DUTCH; ENGLISH summary Submitted for publication
(NLR-MP-85055-U; B8664362; ESA-86-97681) Avail: NTIS HC A02/MF A01

The application of modern control techniques for the development of spacecraft attitude estimation and control algorithms is reviewed. Control theories, and the mathematical modeling of the systems such as optical systems, flexible spacecraft, and liquid sloshing in microgravity are treated. The Modular Attitude Control System (MACS) is presented. The MACS test and simulation assembly, built for ESA, is described. ESA

N86-31637# Societe Nationale Industrielle Aerospatiale, Paris (France).
SPACEBUS: MULTIMISSION COMMUNICATION SATELLITES [SPACEBUS: SATELLITES DE TELECOMMUNICATION MULTIMISSIONS]
A. Daguet 1986 5 p In FRENCH Presented at Journees Industrielles France-Canada, Ottawa, Ontario, 10-12 Sep. 1985
(SNIAS-861-422-119; ESA-86-97604) Avail: NTIS HC A02/MF A01

The Spacebus satellite system is described. The family includes three capacities (Spacebus 100 to 300). The characteristics are a modular design, three axis stabilization, unified two component propulsion and deployable solar generator. Output power is from 1400 W to 6000 W. The mass in synchronous orbit is from 650 kg to 1500 kg. Arabsat is an example of Spacebus 100 design. ESA

N86-31638# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PREDICTION OF THE HIGH FREQUENCY RESPONSE OF SATELLITES TO DIFFUSE ACOUSTIC ENVIRONMENTS
B. Troclet, T. DangTrong, and C. Vidal 1986 7 p Presented at CNES Conference on Structures des Vehicules Spatiaux, Toulouse, France, 2-4 Dec. 1985
(SNIAS-861-422-122; ESA-86-97607) Avail: NTIS HC A02/MF A01

The application of the LASCAR computer program to the analysis of the acoustical response of the Ariane, Sylda and Arabsat spacecraft structures is discussed. The program is an improved version of the BRUIT program, successfully applied to the prediction of Ariane high frequency response. FORTRAN 77 is used, and LASCAR is available on IBM and CDC computers. The program predictions show good agreement with the measured response of complex structures and of equipment box attachment points. ESA

N86-31639# Societe Nationale Industrielle Aerospatiale, Cannes (France).
USE OF MoS2 APPLIED BY PHYSICAL VAPOR DEPOSITION (PVD) ON SPACE MECHANISMS
J. F. Patin, M. Maillat, and H. E. Hintermann 1986 6 p Presented at Second ESA European Symposium on Space Mechanisms and Tribology, Schloss Meersburg, West Germany, 9-11 Oct. 1985
(SNIAS-861-440-101; ESA-86-97610) Avail: NTIS HC A02/MF A01

The laboratory test results of sputter coatings of MoS2 are described. The lubricating film, produced using a physical vapor deposition technique was used in the Arabsat, SPOT and TDF satellites. The test program includes the study of the influence of many parameters, including speed, vacuum, temperature, load, and air humidity in the case of ground tests. The tests show that MoS2 is an excellent lubricant for space mechanisms. The only remaining problem is its high sensitivity to moisture when performing ground tests. ESA

N86-31640# Societe Nationale Industrielle Aerospatiale, Cannes (France).
DESIGN AND TEST OF A SPACE DEPLOYABLE RADIATOR
B. Moschetti, M. Amidieu, and B. Tatry 1986 8 p
(SNIAS-861-440-103; ESA-86-97612) Avail: NTIS HC A02/MF A01

A deployable panel of hinged type where the power is spread over the surface by means of embedded heat pipes and the thermal rotating joints are coaxial with the panel hinge is described. The prototype model has a radiation panel of 800 x 600 mm with 5 embedded heat pipes and 2 radiative faces capability. In the hot case the capability is 160 W to maintain 30 C. Thermal performance test results are given. ESA

N86-31641# Societe Nationale Industrielle Aerospatiale, Cannes (France).
NEW ALUMINUM ALLOYS FOR SATELLITE STRUCTURES
J. L. Cecconi and J. F. Patin 1986 9 p
(SNIAS-861-440-111; ESA-86-97619) Avail: NTIS HC A02/MF A01

The utilization of aluminum-lithium alloys in spacecraft structures is discussed. The weight reduction attainable is 10% to 13% compared with other aluminum alloy options. The applications are examined and carbon fiber reinforced plastic alternatives are analyzed. It is shown that the optimum choice depends on the required shape and properties of the spacecraft constituents. ESA

N86-31642# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
IN-FLIGHT ATTITUDE ESTIMATION AND CONTROL EXPERIMENTS WITH IRAS BASED ON MODERN CONTROL THEORY
A. P. Terpstra, T. Zwartbol, and C. P. R. C. Slippens 19 Apr. 1984 104 p
(Contract NIVR-1998)
(NLR-TR-84029-U; B8665727; ESA-86-98035) Avail: NTIS HC A06/MF A01

In three in-flight experiments with IRAS, algorithms for spacecraft state estimation and attitude control, and for inertial-optical attitude determination were loaded from the ground into the IRAS on-board computer and tested. The estimation and control experiments show that the model following control concept can be applied successfully to maneuvering spacecraft like IRAS and can be used with any type of closed-loop regulator. The inertial-optical attitude determination experiment demonstrates the feasibility of in-orbit estimation of gyro drift using measurements by an absolute attitude sensor. ESA

N86-31643# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
DYNAMICS OF FLEXIBLE SPACECRAFT: AN ANALYSIS OF APPROACHES TOWARDS MATHEMATICAL MODEL ORDER REDUCT ION
P. Th. L. M. vanWoerkom 16 Apr. 1985 202 p
(Contract NIVR-1910)
(NLR-TR-85068-U; B8665500; ESA-86-98038) Avail: NTIS HC A10/MF A01

Reduction of the mathematical order (i.e., of the mathematical complexity) of the open loop spacecraft dynamics model with minimal loss of model accuracy is discussed. Approaches to open loop model order reduction were analyzed regarding application to dynamic models of flexible spacecraft. Parameter optimization, aggregation, singular perturbation, modal dominance, and component cost analysis were compared. The latter two approaches appear to be most meaningful and convenient amongst the five. ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-31644# Officine Galileo S.p.A., Florence (Italy).
STANDARD CALIBRATION PROCEDURE FOR PENCIL BEAM INFRARED SENSORS ON SPINNING SATELLITES, VOLUME 1 Final Report
Roberta Baldassini Fontana and Ivo Varano Paris, France ESA Jan. 1982 158 p
(Contract ESTEC-3843/79-NL-DG(SC))
(Rept-209-DT-54-Vol-1; ESA-CR(P)-2155-Vol-1; ESA-86-97486-Vol-1) Avail: NTIS HC A08/MF A01

A standard procedure for the calibration of pencil beam IR sensors, based on a simplified laboratory test program that, in conjunction with a suitable software, allows the determination of the unit's operative characteristics in standard laboratory conditions, was developed. The sensor parameters so defined, processed by a computer program together with other input parameters available at the spacecraft control operative center, provide an effective use of the sensor for attitude reconstruction beyond the conditions simulated in laboratory. The procedure simplifies the required tests, and gives better accuracy thanks to the quantity of the available input data processed by the computer. ESA

N86-31645# Officine Galileo S.p.A., Florence (Italy).
STANDARD CALIBRATION PROCEDURE FOR PENCIL BEAM INFRARED SENSORS ON SPINNING SATELLITES. VOLUME 2: APPLICABLE SOFTWARE AND USER MANUALS Final Report
Roberta Baldassini Fontana and Lido Cecconi Paris, France ESA Jan. 1982 44 p
(Contract ESTEC-3843/79-NL-DG(SC))
(Rept-209-DT-55-Vol-2; ESA-CR(P)-2155-Vol-2; ESA-86-97487-Vol-2) Avail: NTIS HC A03/MF A01

The updating and testing software for general satellite-borne IR sensor electronics, nonuniform detector responsivity, and optional rotation of the field of view around the telescope line of sight are described. Two standardized packages of software useful for optimizing the sensor parameters and for generating calibration data relative to the specific mission were produced. ESA

N86-32010*# Ball Aerospace Systems Div., Boulder, Colo.
SUBSYSTEM FACT SHEETS FOR NASA CO2 PROJECT, REVISION 3
Tom Lookabaugh *In* Little (Arthur D.), Inc. System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 212 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-31646*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEST PROGRAM TO PROVIDE CONFIDENCE IN LIQUID OXYGEN COOLING OF HYDROCARBON FUELED ROCKET THRUST CHAMBERS
Elizabeth S. Armstrong 1986 11 p Presented at the JANNAF Propulsion Meeting, New Orleans, La., 25-28 Aug. 1986

(NASA-TM-88816; E-3174; NAS 1.15:88816) Avail: NTIS HC A02/MF A01 CSCL 21H

An experimental program has been planned at the NASA Lewis Research Center to build confidence in the feasibility of liquid oxygen cooling for hydrocarbon fueled rocket engines. Although liquid oxygen cooling has previously been incorporated in test hardware, more runtime is necessary to gain confidence in this concept. In the previous tests, small oxygen leaks developed at the throat of the thrust chamber and film cooled the hot-gas side of the chamber wall without resulting in catastrophic failure. However, more testing is necessary to demonstrate that a catastrophic failure would not occur if cracks developed further upstream between the injector and the throat, where the boundary layer has not been established. Since under normal conditions cracks are expected to form in the throat region of the thrust chamber, cracks must be initiated artificially in order to control their location. Several methods of crack initiation are discussed in this report. Four thrust chambers, three with cracks and one without, should be tested. The axial location of the cracks should be varied parametrically. Each chamber should be instrumented to determine the effects of the cracks, as well as the overall performance and durability of the chambers. Author

N86-31647*# Rockwell International Corp., Canoga Park, Calif. Propulsion Programs.

SPACE STATION PROPULSION TECHNOLOGY Annual Progress Report, 24 May 1985 - 23 May 1986

G. L. Briley 1986 92 p

(Contract NAS8-36418)

(NASA-CR-178897; NAS 1.26:178897; RI/RD86-226; Rept-0737p-105-; APR-1) Avail: NTIS HC A05/MF A01 CSCL 21H

The progress on the Space Station Propulsion Technology Program is described. The objectives are to provide a demonstration of hydrogen/oxygen propulsion technology readiness for the Initial Operating Capability (IOC) space station application, specifically gaseous hydrogen/oxygen and warm hydrogen thruster concepts, and to establish a means for evolving from the IOC space station propulsion to that required to support and interface with advanced station functions. The evaluation of concepts was completed. The accumulator module of the test bed was completed and, with the microprocessor controller, delivered to NASA-MSFC. An oxygen/hydrogen thruster was modified for use with the test bed and successfully tested at mixture ratios from 4:1 to 8:1. B.G.

N86-31648*# Page (R. J.) Co., Santa Ana, Calif.

SLIP CASTING AND EXTRUDING SHAPES OF RHENIUM WITH METAL OXIDE ADDITIVES. 1: FEASIBILITY DEMONSTRATION

Francis A. Barr and Russell J. Page Apr. 1986 17 p

(Contract NAS3-23884)

(NASA-CR-174970; NAS 1.26:174970) Avail: NTIS HC A02/MF A01 CSCL 11F

The feasibility of fabricating small rhenium parts with metal oxide additives by means of slip casting and extrusion techniques is described. The metal oxides, ZrO_2 and HfO_2 were stabilized into the cubic phase with Y_2O_3. Additions of metal oxide to the rhenium of up to 15 weight percent were used. Tubes of 17 mm diameter with 0.5 mm walls were slip cast by adapting current ceramic oxide techniques. A complete cast double conical nozzle demonstrated the ability to meet shapes and tolerances. Extrusion of meter long tubing lengths of 3.9 mm o.d. x 2.3 mm i.d. final dimension is documented. Sintering schedules are presented to produce better than 95% of theoretical density parts. Finished machining was found possible were requried by electric discharge machining and diamond grinding. Author

N86-31649*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF A HYBRID HYDROSTATIC BEARING FOR CRYOGENIC TURBOPUMP APPLICATION

Paul W. Spica, Ned P. Hannum, and Scott D. Meyer 1986 19 p

(NASA-TM-87255; E-2945; NAS 1.15:87255) Avail: NTIS HC A02/MF A01 CSCL 13K

A hybrid hydrostatic bearing was deaigned to operate in liquid hydrogen at speeds to 80,000 rpm and radial loads to 440 n (100 lbf). The bearing assembly consisted of a pair of 20-mm angular-contact ball bearings encased in a journal, which was in turn supported by a fluid film of liquid hydrogen. The size and operating conditions of the bearing were selected to be compatible with the operating requirements of an advanced technology turbopump. Several test parameters were varied to characterize the bearing's steady-state operation. The rotation of the tester shaft was varied between 0 and 80,000 rpm. Bearing inlet fluid pressure was varied between 2.07 and 4.48 MPa (300 and 650 psia), while the fluid sump pressure was independently varied between 0.34 and 2.07 MPa (50 and 300 psia). The maximum radial load applied to the bearing was 440 N (110 lbf). Measured hybrid-hydrostatic-bearing stiffness was 1.5 times greater than predicted, while the fluid flow rate through the bearing was 35 to 65 percent less than predicted. Under two-phase fluid conditions, the stiffness was even greater and the flow rate was less. The optimal pressure ratio for the bearing should be between 0.2 and 0.55 depending on the balance desired between bearing efficiency and stiffness. Startup and shutdown cyclic tests were conducted to demonstrate the ability of the hybrid-hydrostatic-bearing assembly to survive at least a 300-firing-duty cycle. For a typical cycle, the shaft was accelerated to 50,000 rpm in 1.8 sec. The bearing operated for 337 start-stop cycles without failure. Author

N86-31650*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE CHARACTERISTICS OF RING-CUSP THRUSTERS WITH XENON PROPELLANT

Michael J. Patterson 1986 35 p Presented at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; sponsored by AIAA, ASME, SAE and ASEE

(NASA-TM-87338; E-3085; NAS 1.15:87338; AIAA-86-1392) Avail: NTIS HC A03/MF A01 CSCL 21H

The performance characteristics and operating envelope of several 30-cm ring-cusp ion thrusters with xenon propellant were investigated. Results indicate a strong performance dependence on the discharge chamber boundary magnetic fields and resultant distribution of electron currents. Significant improvements in discharge performance over J-series divergent-field thrusters were achieved for large throttling ranges, which translate into reduced cathode emission currents and reduced power dissipation which should be of significant benefit for operation at thruster power levels in excess of 10 kW. Mass spectrometry of the ion beam was documented for both the ring-cusp and J-series thrusters with xenon propellant for determination of overall thruster efficiency, and lifetime. Based on the lower centerline values of doubly charged ions in the ion beam and the lower operating discharge voltage, the screen grid erosion rate of the ring-cusp thruster is expected to be lower than the divergent-field J-series thruster by a factor of 2. Author

N86-31651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE NONCAVITATING PERFORMANCE AND LIFE OF A SMALL VANE-TYPE POSITIVE DISPLACEMENT PUMP IN LIQUID HYDROGEN

Thomas E. Ulbricht and Joseph A. Hemminger 1986 28 p Presented at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; sponsored by AIAA, ASME, SAE and ASEE

(NASA-TM-87347; E-3100; NAS 1.15:87347; AIAA-86-1438) Avail: NTIS HC A03/MF A01 CSCL 21H

The low flow rate and high head rise requirements of hydrogen/oxygen auxiliary propulsion systems make the application of centrifugal pumps difficult. Positive displacement pumps are well-suited for these flow conditions, but little is known about their performance and life characteristics in liquid hydrogen. An experimental and analytical investigation was conducted to determine the performance and life characteristics of a vane-type, positive displacement pump. In the experimental part of this effort, mass flow rate and shaft torque were determined as functions of

shaft speed and pump pressure rise. Since liquid hydrogen offers little lubrication in a rubbing situation, pump life is an issue. During the life test, the pump was operated intermittently for 10 hr at the steady-state point of 0.074 lbm/sec (0.03 kg/sec) flow rate, 3000 psid (2.07 MPa) pressure rise, and 8000 rpm (838 rad/sec) shaft speed. Pump performance was monitored during the life test series and the results indicated no loss in performance. Material loss from the vanes was recorded and wear of the other components was documented. In the analytical part of this effort, a comprehensive pump performance analysis computer code, developed in-house, was used to predict pump performance. The results of the experimental investigation are presented and compared with the results of the analysis. Results of the life test are also presented. M.G.

N86-31652*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE GAS PARTICLE RADIATOR (GPR)
Donald L. Chubb Jul. 1986 35 p
(NASA-TM-88786; E-2639-1; NAS 1.15:88786) Avail: NTIS HC A03/MF A01 CSCL 20D

The theoretical performance of a new space radiator concept, the gas particle radiator (GPR), is calculated. The GPR uses a gas containing emitting, submicron particles as the radiating media. A transparent window contains the gas particle mixture around the solid radiator emitting surface. A major advantage of the GPR is that large emissivity (e sub T is greater than or = 0.8) is achieved without the use of emissive coatings. A radiation heat transfer analysis shows that for a modest volume fraction (approx. 10(-4)) of submicron particles and gas thickness (approx. 1 cm) the emissivity, e sub T, is limited by the window transmittance. Besides determining the emissivity, the window is the critical element for making it possible for the GPR to have lower mass than a tube type radiator. The window acts as a bumper to provide meteoroid protection for the radiator wall. The GPR was compared to a proposed titanium wall, potassium heat pipe radiator. For both radiators operating at a power level of 1.01 MW at 775 K it was calculated that the GPR mass was 31 percent lower than the heat pipe radiator. Author

N86-31653*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DETERMINATION OF SOLID ROCKET MOTOR (SRM) CASE SEGMENT GROWTH
Lisa Hanks Mitchell Jul. 1986 15 p
(NASA-TM-86557; NAS 1.15:86557) Avail: NTIS HC A02/MF A01 CSCL 21H

Presented is an assessment of case growth for two D6AC steel SRM case segments with multiple flight use and a comparison of these two cases with two new cases. Dimensional changes in the sealing diameter areas were recorded for the used cases and after hydroproofing of the new cases. Author

N86-31654*# Continuum, Inc., Huntsville, Ala.
SSME MAIN COMBUSTION CHAMBER AND NOZZLE FLOWFIELD ANALYSIS Final Report
Richard C. Farmer, Ten-See Wang, Sheldon D. Smith, and Robert J. Prozan 1 Mar. 1986 43 p
(Contract NAS8-35510)
(NASA-CR-178893; NAS 1.26:178893; CI-FR-0085) Avail: NTIS HC A03/MF A01 CSCL 21H

An investigation is presented of the computational fluid dynamics (CFD) tools which would accurately analyze main combustion chamber and nozzle flow. The importance of combustion phenomena and local variations in mixture ratio are fully appreciated; however, the computational aspects of the gas dynamics involved were the sole issues addressed. The CFD analyses made are first compared with conventional nozzle analyses to determine the accuracy for steady flows, and then transient analyses are discussed. Author

N86-31655# Department of the Air Force, Washington, D.C.
SOLID ROCKET MOTOR WITH NOZZLE CONTAINING AROMATIC AMIDE FIBERS Patent
Joseph W. Lewis, inventor (to Air Force) Issued 11 Mar. 1986 5 p
(AD-D012250; US-Patent-4,574,700; US-Patent-Appl-SN-671395; US-Patent-Class-102-287) Avail: US Patent and Trademark Office CSCL 21/8

It is an object of the present invention to provide an improved nozzleless solid rocket motor comprising means for reducing erosive burning effects in the nozzle portion. In accordance with the present invention there is provided a solid rocket motor comprising a rocket case having a closed front end and an open second end, and a centrally ported propellant grain comprising a main portion and a nozzle portion, wherein the main portion is a shaped and cured first propellant, wherein the nozzle portion comprises a shaped and cured second propellant composition having a plurality of aromaic polyamide fibers dispersed throughout. GRA

N86-31656# Department of the Air Force, Washington, D.C.
DOME RESTRAINT ASSEMBLY FOR ROCKET MOTORS Patent
Peter F. ODriscoll, inventor (to Air Force) 25 Mar. 1986 7 p Supersedes AD-D011041
(AD-D012278; US-Patent-4,577,542; US-Patent-Appl-SN-586952; US-Patent-Class-86-20D) Avail: US Patent and Trademark Office CSCL 21/8

This invention relates to an adjustable restraint assembly connectable between a dome portion of a solid propellant rocket motor casing and a rigid base or support, for use during the curing of a propellant in the casing. The assembly includes an upper attach bracket connectable to the dome portion, a lower attach bracket connectable to a rigid base, upper and lower brackets, respectively, and an adjustable threaded turn-buckle-like member connected between the flanges. The assembly is used to establish a maximum net downward deflection of the dome portion upon maximum pressurization of the uncured propellant in the motor casing and is thereafter adjusted at various times during the curing process to reduce and ultimately eliminate the deflection in increments to thereby improve the bond between the grains of the cured propellant and the casing in the region of the forward dome. GRA

N86-31657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY ON ALGORITHMS FOR PREDICTION OF SOLID PROPELLANT ROCKET MOTOR PERFORMANCE
Xin Wang and Zhongqin Zhang 22 Apr. 1986 15 p Transl. into ENGLISH from Hang Kong Xuebao (China), v. 5, no. 3, Sep. 1984 p 288-295
(AD-A167842; FTD-ID(RS)T-0152-86) Avail: NTIS HC A02/MF A01 CSCL 21/8

This article introduces two predictive algorithms for the performance of solid propellant rocket motor. The emphasis is on the introduction of Time-Space Algorithm. The authors proposed a general two-dimensional grain calculation procedure in order to conduct the grain calculations. Therefore, the predictive algorithms for performance introduced by this article show generality. A comprehensive computer program for the aforementioned method has been written and applied to calculating the performance of three different solid rocket motors. The calculated results are consistent with those derived from experimental data. GRA

N86-31658# European Space Agency, Paris (France).
THE HIGHLY UNDEREXPANDED EXHAUST PLUME FROM NOZZLES WITH BOUNDARY LAYER
Karl Wieland Naumann Sep. 1985 114 p Original language document was announced as N85-31230
(ESA-TT-929; DFVLR-FB-85-10; ESA-86-97573) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne, West Germany DM 28

The expansion of underexpanded free jets from a conical hypersonic nozzle is analyzed for Reynolds numbers typical of satellite attitude control thrusters. The laminar nozzle boundary

layer is measured. Streamlines in the free jet and the flow conditions inside the barrel shock are determined. Comparison with the Simons continuum plume model shows discrepancies proceeding from rarefaction effects in the Prandtl-Meyer expansion originating at the nozzle lip (freezing of the expansion curvature). The suitable formulation of a freezing parameter allows the fixing of the frozen streamline directions and flow conditions in the free jet expansion even for the streamlines originating from the nozzle boundary layer. Approximated free jet configurations show good agreement with experiments. ESA

N86-31659# Societe Europeenne de Propulsion, Vernon (France).
ADVANTAGES AND LIMITATIONS OF LIQUID PROPELLANT ROCKET ENGINES [GRANDEUR ET SERVITUDES DE LA PROPULSION PAR MOTEURS FUSEES A LIQUIDES]
Philippe Bordier and Philippe Buffet 1984 8 p In FRENCH
(ESA-86-97631) Avail: NTIS HC A02/MF A01

The design of rocket engines is discussed, with particular reference to the Ariane launch vehicle. The parameters affecting engine efficiency are explained as well as the design problems. Trends are illustrated by the description of the HM60 engine which is a H2/O2 system in development for the future Ariane 5 launcher. The HM60 is designed for 900 kN thrust. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-31660# Wisconsin Univ., Madison. Dept. of Chemistry.
CHEMICAL REACTIONS AND PROPERTIES OF ORGANOSILICON COMPOUNDS RELATED TO NEW MATERIALS Final Report, 1 Feb. 1982 - 30 Sep. 1985
Robert West 31 Oct. 1985 23 p
(Contract F49620-83-C-0044)
(AD-A166338; AFOSR-86-0144TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

The chemistry of compounds containing silicon-silicon double bonds was investigated. Two new disilenes were synthesized and rotational barriers to cis-trans interconversion were determined to be 25-31 Kcal/mol. Oxidation of disilenes led to the 1,3-cyclodisiloxanes, as well as to disilene epoxide and 1,2-dioxetanes, all novel structures. Many new polysilane high polymers were synthesized, and their photoactivity was investigated. Several new methods for crosslinking of polysilanes were developed, and the first polysilanes containing functional side groups were prepared. Several cyclosilane families of compounds were also investigated. GRA

N86-31661# Lawrence Livermore National Lab., Calif.
CHEMISTRY RESEARCH RESOURCE Progress Report, Feb. 1986
Mar. 1986 93 p
(Contract W-7405-eng-48)
(DE86-009393; UCID-20622-86-2) Avail: NTIS HC A05/MF A01

Research is reported in the following fields: synthesis of new materials; development of analytical techniques; chemical kinetics and transport processes; cryogenic and other physical properties of hydrogen isotopes; artificial intelligence; development of techniques for characterization; materials modelling analysis; mechanical properties of polymers; physical metallurgy; phase transformations; surface modification and surface studies; and new materials development and properties. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N86-31662# Royal Aircraft Establishment, Farnborough (England).
AUTOCLAVE MOULDING OF CARBON FIBRE REINFORCED PLASTICS
D. Purslow and R. Childs 15 Apr. 1986 33 p
(RAE-TR-85039; RAE-Mat/Struct-121; BR97683; ESA-86-97260) Avail: Issuing Activity

Cure cycles in autoclave molding of CFRP are discussed. Partial-cure, dwell-time, dual vacuum, and dual pressure were examined. Their significance to laminate quality is explained. It is argued that the packing of the fibers is determined by processes other than, and remote from, the autoclave. Thus the final thickness and fiber volume fraction are not under the autoclave operator's control. The cure cycle must be tuned to give, not a specific thickness, but that thickness which is inherent in the prepreg laminae used. The common factor behind all these phenomena is shown to be the relationship of viscosity to gel time in that resin can flow only until gelation effectively stops all flow. ESA

N86-31663*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER COMPOSITE SANDWICH THERMOSTRUCTURAL BEHAVIOR: COMPUTATIONAL SIMULATION
C. C. Chamis, R. A. Aiello, and P. L. N. Murthy (Cleveland State Univ., Ohio) 1986 18 p Presented at the 27th Structures, Structural Dynamics and Materials Conference (SDM), San Antonio, Tex., 19-21 May 1986; sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-88787; E-3112; NAS 1.15:88787) Avail: NTIS HC A02/MF A01 CSCL 11D

Several computational levels of progressive sophistication/simplification are described to computationally simulate composite sandwich hygral, thermal, and structural behavior. The computational levels of sophistication include: (1) three-dimensional detailed finite element modeling of the honeycomb, the adhesive and the composite faces; (2) three-dimensional finite element modeling of the honeycomb assumed to be an equivalent continuous, homogeneous medium, the adhesive and the composite faces; (3) laminate theory simulation where the honeycomb (metal or composite) is assumed to consist of plies with equivalent properties; and (4) derivations of approximate, simplified equations for thermal and mechanical properties by simulating the honeycomb as an equivalent homogeneous medium. The approximate equations are combined with composite hygrothermomechanical and laminate theories to provide a simple and effective computational procedure for simulating the thermomechanical/thermostructural behavior of fiber composite sandwich structures. Author

N86-31664*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ICAN: A VERSATILE CODE FOR PREDICTING COMPOSITE PROPERTIES
Carol A. Ginty and Christos C. Chamis 1986 20 p Presented at the 31st National SAMPE Symposium and Exhibition, Las Vegas, Nev., 7-10 Apr. 1986
(NASA-TM-87334; E-2017; NAS 1.15:87334) Avail: NTIS HC A02/MF A01 CSCL 11D

The Integrated Composites ANalyzer (ICAN), a stand-alone computer code, incorporates micromechanics equations and laminate theory to analyze/design multilayered fiber composite structures. Procedures for both the implementation of new data in ICAN and the selection of appropriate measured data are summarized for: (1) composite systems subject to severe thermal environments; (2) woven fabric/cloth composites; and (3) the selection of new composite systems including those made from high strain-to-fracture fibers. The comparisons demonstrate the versatility of ICAN as a reliable method for determining composite properties suitable for preliminary design. M.G.

N86-31665*# Rensselaer Polytechnic Inst., Troy, N.Y.
COMPOSITE STRUCTURAL MATERIALS Annual Progress Report, 1 May 1985 - 30 Apr. 1986
Robert Loewy and Stephen E. Wiberley Aug. 1986 119 p

(Grant NGL-33-018-003)
(NASA-CR-179659; NAS 1.26:179659; Rept-49) Avail: NTIS HC A06/MF A01 CSCL 11D

Overall emphasis is on basic long-term research in the following categories: constituent materials, composite materials, generic structural elements, processing science technology; and maintaining long-term structural integrity. Research in basic composition, characteristics, and processing science of composite materials and their constituents is balanced against the mechanics, conceptual design, fabrication, and testing of generic structural elements typical of aerospace vehicles so as to encourage the discovery of unusual solutions to present and future problems. Detailed descriptions of the progress achieved in the various component parts of this comprehensive program are presented. B.G.

N86-31666*# Materials Sciences Corp., Spring House, Pa.
TEMPERATURE DEPENDENT NONLINEAR METAL MATRIX LAMINAE BEHAVIOR Final Technical Report, Dec. 1984 - Nov. 1985
David J. Barrett and Kent W. Buesking Washington NASA Sep. 1986 123 p
(NAS1-17822)
(NASA-CR-4016; NAS 1.26:4016; MSC-TFR-1607/0211) Avail: NTIS HC A06/MF A01 CSCL 11D

An analytical method is described for computing the nonlinear thermal and mechanical response of laminated plates. The material model focuses upon the behavior of metal matrix materials by relating the nonlinear composite response to plasticity effects in the matrix. The foundation of the analysis is the unidirectional material model which is used to compute the instantaneous properties of the lamina based upon the properties of the fibers and matrix. The unidirectional model assumes that the fibers properties are constant with temperature and assumes that the matrix can be modelled as a temperature dependent, bilinear, kinematically hardening material. An incremental approach is used to compute average stresses in the fibers and matrix caused by arbitrary mechanical and thermal loads. The layer model is incorporated in an incremental laminated plate theory to compute the nonlinear response of laminated metal matrix composites of general orientation and stacking sequence. The report includes comparisons of the method with other analytical approaches and compares theoretical calculations with measured experimental material behavior. A section is included which describes the limitations of the material model. M.G.

N86-31667# Department of the Navy, Washington, D. C.
PROCESS FOR PRODUCING CARBIDE COATINGS Patent
Irwin L. Singer and Russell A. Jeffries, inventors (to Navy) Issued 21 Jan. 1986 4 p Supersedes AD-D011295
(AD-D012202; US-Patent-4,565,710; US-Patent-Appl-SN-617777; US-Patent-Class-427-35) Avail: US Patent and Trademark Office CSCL 11/6

A surface alloy is formed upon a solid alloy substrate by implanting ions into a heated solid substrate. By this method, for example, an Ti binary surface alloy may be formed upon a carbon steel. Also, this process allows solid-state gettering of selected minority solutes in alloys. GRA

N86-31668# Martin Marietta Aerospace, Denver, Colo.
DAMPING CHARACTERISTICS OF METAL MATRIX COMPOSITES Quarterly Letter Report
10 Apr. 1986 6 p
(Contract N00014-85-C-0857)
(AD-A167792; MCR-85-721) Avail: NTIS HC A02/MF A01 CSCL 11/4

Damping test data of Gr/Al composites, from previous measurements at Martin Marietta Denver Aerospace, CO suggest that composites exhibit higher damping than aluminum and titanium base structural alloys. Enhanced material damping of metal matrix composite (MMC), as a structural material will significantly improve the stability control and reliability of space structures. The objectives of the present investigation are: (1) to identify the mechanism and the source of damping in MMC (P55 Gr/6061 Al); (2) to determine the role of microstructural parameters, e.g., fiber volume, fiber orientation and interfiber spacing, and (3) to define the role of fiber matrix interfaces. GRA

N86-31669# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
DEVELOPMENT OF FRACTURE MECHANICS MAPS FOR COMPOSITE MATERIALS, VOLUME 1 Final Report, Jan. 1982 - Jan. 1985
H. W. Bergmann Dec. 1985 224 p
(AD-A168002; AFWAL-TR-85-4150-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 11/4

The Institute for Structural Mechanics of the German Aerospace Research Establishment (DFVLR) has conducted a research program aimed at the characterization of the fracture behavior of carbon-fiber-reinforced epoxy resins. The research effort encompassed to comprehensive experimental and analytical investigation of the response of test specimens under a broad range of material, loading and environmental parameters. By combining an evaluation of global laminate properties with an investigation of miro-and macroscopic modes of failure, the understanding of the fracture and fatigue behavior of carbon-fiber-reinforced composites was enhanced. It is expected that the results of the research program and their representation in the form of tables, figures, graphs and maps will assist the design engineer and lead to improved engineering concepts. GRA

N86-31670# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
DEVELOPMENT OF FRACTURE MECHANICS MAPS FOR COMPOSITE MATERIALS, VOLUME 2 Final Report, Jan. 1982 - Jan. 1985
H. W. Bergmann Dec. 1985 208 p
(AD-A168003; AFWAL-TR-85-4150-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 11/4

The Institute for Structural Mechanics of the German Aerospace Research Establishment (DFVLR) has conducted a research program aimed at the characterization of the fracture behavior of carbon-fiber-reinforced epoxy resins. The research effort encompassed a comprehensive experimental and analytical investigation of the response of test specimens under a broad range of material, loading and environmental parameters. By combining an evaluation of global laminate properties with an investigation of micro- and macroscopic modes of failure, the understanding of the fracture and fatigue behavior of carbonfiber-reinforced composites was enhanced. It is expected that the results of the research program and their representation in the form of tables, figures, graphs and maps will assist the design engineer and lead to improved engineering concepts. Volume 2 includes the following: Response of Mechanically Fatigued Notched Specimens; Response of Thermally Fatigued Un-Notched Specimens; Strain Capabilities and Strain Rate Effects in Epoxy Resins and Laminates; Radiative and Oxidative Effects; Fractographical Investigations; Fracture Mechanics Aspects; Evaluation of Fracture Models; and Mechanisms of Fracture. GRA

N86-31671# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
DEVELOPMENT OF FRACTURE MECHANICS MAPS FOR COMPOSITE MATERIALS, VOLUME 3 Final Report, Jan. 1982 - Jan. 1985
H. W. Bergmann Dec. 1985 268 p
(AD-A168004; AFWAL-TR-85-4150-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 11/4

The Institute for Structural Mechanics of the German Aerospace Research Establishment (DFVLR) has conducted a research program aimed at the characterization of the fracture behavior of carbon-fiber-reinforced epoxy resins. The research effort encompassed a comprehensive experimental and analytical investigation of the response of test specimens under a broad range of material, loading and environmental parameters. By combining an evaluation of global laminate properties with an investigation of micro- and macroscopic modes of failure, the understanding of the fracture

and fatigue behavior of carbon-fiber-reinforced composites was enhanced. It is expected that the results of the research program and their representation in the form of tables, figures, graphs and maps will assist the design engineer and lead to improved engineering concepts. GRA

N86-31672# Washington Univ., St. Louis, Mo. Center for Composites Research.
DAMAGE ASSESSMENT BY ACOUSTO-ULTRASONIC TECHNIQUES IN COMPOSITES
Luis Lorenzo and H. T. Hahn Apr. 1986 41 p
(Contract N00014-85-K-0795)
(AD-A168097; WU/CCR-86/2) Avail: NTIS HC A03/MF A01 CSCL 11/7

This paper addresses the non-destructive evaluation of cross-ply 0/90 subscript 2S and 90/0 subscript 2S S-2 G1/DER 332 laminates using acousto-ultrasonic and acoustic emission techniques. Acoustic emission and acousto-ultrasonic measurements gave early warnings of damage initiation before transverse cracks became visible. AU parameters such as peak amplitude, energy and stress wave factor were equally sensitive to damage initiation but peak amplitude and energy were more sensitive to damage accumulation. Variations of peak amplitude, event duration, ringdown counts, and rise time in AU tests were analyzed to show that internal damage not only increased the apparent attenuation but also affected the wave envelope. The same effect was also present in AE tests. Acousto-ultrasonic tests of an undamaged cross-ply laminate showed that the apparent attenuation coefficients were almost independent of the wave propagation direction. The strongest wave was found along the fibers in the ply in contact with the transducers and the weakest wave traveled at an angle of 45 deg to the fibers. GRA

N86-31673# Lawrence Livermore National Lab., Calif.
MECHANICS RESEARCH DIRECTIONS IN COMPOSITES AND MANUFACTURING TECHNOLOGIES
R. M. Christensen Mar. 1986 22 p
(Contract W-7405-eng-48)
(DE86-008787; UCID-20691) Avail: NTIS HC A02/MF A01

This document is comprised of two papers: mechanics of fiber composites; and manufacturing and processing (of metals, ceramics, polymers). In the first, life predictions based on damage kinetics for various types of composite material combinations are studied. Structural optimization using the inherent anisotropy of composites offers potential rewards of increased performance. In the second, manufacturing and materials processing provide a wide spectrum of mechanics related problems. The reduction in defects ultimately relates to controlled processes which in turn come from realistic modelling of the physical events. New methods to produce lightweight materials with carefully controlled microstructure is studied. E.R.

N86-31674# Sandia National Labs., Albuquerque, N. Mex.
MECHANICAL TESTING OF GRAPHITE-EPOXY COMPOSITE TUBES
W. A. Kawahara, J. J. Totten, J. S. Korellis, and S. L. Brandon Apr. 1986 31 p
(Contract DE-AC04-76DP-00789)
(DE86-009608; SAND-86-8216) Avail: NTIS HC A03/MF A01

The in-plane elastic moduli of a unidirectional graphite-epoxy laminate were evaluated by loading tubular specimens in tension, torsion, and internal pressure. Similarly, effective moduli for crossply tubes of a prescribed lay-up were evaluated, then compared with predictions based upon plate lamination theory and the unidirectional moduli. Fixture design and software for test control, data acquisition, and data reduction are documented. DOE

N86-31675# Sandia National Labs., Livermore, Calif.
STRONGBACK BASELINE DESIGN: MECHANICAL PROPERTIES OF COMPOSITE FACESHEETS
W. A. Kawahara, M. L. Tootle, C. E. Comroe, and J. J. Totten May 1986 28 p
(Contract DE-AC04-76DR-00789)
(DE86-011913; SAND-86-8221) Avail: NTIS HC A03/MF A01

A current Sandia project responsibility involves the design and construction of a structure requiring high stiffness to weight ratio and extreme thermal stability. To meet these requirements, a baseline design proposes a sandwich type construction with facesheets composed of Pitch 75/ 3501-6 graphite/epoxy composite material. We have performed experiments to quantify the in-plane stiffness characteristics of this material. These tests are essential for two reasons. First, the results are to be input into a structural computer code to perform numerical simulations of component performance. Second, it is essential to verify that the fabricated product meets the specifications claimed by the vendor: this is especially important for composite materials because the final product depends strongly upon raw material condition as well as the layup and autoclaving procedures. Finally, we report preliminary attempts at measuring the in-plane thermal expansion coefficients of the composite plates using strain gages. DOE

N86-31676# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
DEVELOPMENT AND APPLICATION OF ENERGY ABSORBING COMPOSITE DEVICES IN CRASH-WORTHY STRUCTURES
J. K. Wells 1985 20 p
(ESA-86-97253) Avail: NTIS HC A02/MF A01

By careful control of fiber, resin, and geometrical parameters, structural composite sections which collapse in a progressive manner, absorbing a large amount of energy, were developed. Energy absorption per unit weight is between 5 and 10 times that of metallic structures. A wide variety of fibers, resins and constructions were tested at speeds between quasi-static and 17 m/sec (40 mph). The variability of the sustained load during collapse and the control of break-out load are discussed. Applications of the technology for automotive and aerospace uses are discussed. The devices are shown to offer a very low weight solution to energy absorption problems. ESA

N86-31677# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.
CONTRIBUTION OF CARBON FIBERS TO THE IMPROVEMENT OF THE PERFORMANCE OF COMPOSITE CONTAINERS [CONTRIBUTION DE LA FIBRE DE CARBONE A L'AMELIORATION DES PERFORMANCES DES RESERVOIRS COMPOSITES]
Georges Reuille and Alain Pradier 1986 10 p In FRENCH Presented at Journees Europeennes des Composites, 4-5 Mar. 1986
(SNIAS-861-430-115; ESA-86-97609) Avail: NTIS HC A02/MF A01

The characteristics of metal lined carbon fiber composite containers used for satellite fuel storage are discussed. A comparison is made with pure titanium and titanium/Kevlar composite designs. The tank is made of a 0.9 mm titanium shell covered by 9 layers of carbon epoxy composite wound directly over the metallic shell. The operating pressure is 300 bar. It is shown that the proposed design has for the same volume (51 lt) a lower mass and a higher breaking pressure than the equivalent Kevlar design. ESA

N86-31678# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SPECIFIC NEED FOR COMPOSITE STRUCTURES IN AEROSPACE APPLICATIONS
F. Perez 1986 9 p Presented at MRS Conference on Advanced Materials Research and Development for Transport, Strasbourg, France, 26-29 Nov. 1985
(SNIAS-861-422-111; ESA-86-97598) Avail: NTIS HC A02/MF A01

The application of carbon fiber reinforced plastics to launcher and satellite structures, satellite antennas, and optical supports are reviewed. The advantages given by high strength, high modulus, and low thermal expansion coefficient are discussed. The applica-

tions to the Ariane program are described and the development of European technological ability in this field is examined. ESA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-31679# Defence Research Information Centre, Orpington (England).

PHASE-SENSITIVE a.c. POLAROGRAPHY AND ITS DATA PROCESSING BY MICROCOMPUTER-CONTROLLED ELECTROANALYTICAL SYSTEM

T. Wasa (Osaka Perfecture, Japan), K. Akimoto, and H. Yamamoto Dec. 1985 13 p Transl. into ENGLISH from Bunseki Kagaku (Japan). v. 33, no. 8, 1984 p T69-T72

(DRIC-T-7634; BR98337; ESA-86-97262) Avail: Issuing Activity

A phase-sensitive ac polarograph and its automatic data-processing system were constructed through incorporation of a small-amplitude ac voltage source, an IR-drop compensator, and a lock-in amplifier into a microcomputer-controlled, electroanalytical system. System control and data-processing programs are the same as those of differential pulse polarography. System performance and applicability are evaluated through comparison of results obtained by computer data processing and manual treatment. The overall precision of the system for determination of depolarizers [Pb (II), Cd (II), Zn (III), pyrazinamide, etc.] in the range 0.02 nM to 0.5 nM is within 2% for peak current, 1% for peak potential, and 2% for half-peak width. Data-processing time is 1 to 3 min/peak. Characteristics of the fitting functions, such as Gaussian, Lorenzian, and theoretical equations are investigated. ESA

N86-31680*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A MATHEMATICAL APPROACH FOR EVALUATING NICKEL-HYDROGEN CELLS

Harold F. Leibecki 1986 18 p Proposed for presentation at the 1986 Fall Annual Meeting of the AIChE, Miami, Fla., 2-7 Nov. 1986

(NASA-TM-88803; E-3114; NAS 1.15:88803) Avail: NTIS HC A02/MF A01 CSCL 10C

A mathematical equation is presented which gives a quantitative relationship between time-voltage discharge curves, when a cell's ampere-hour capacity is determined at a constant discharge current. In particular the equation quantifies the initial exponential voltage decay; the rate of voltage decay; the overall voltage shift of the curve and the total capacity of the cell at the given discharge current. The results of 12 nickel-hydrogen boiler plate cells cycled to 80 percent depth-of-discharge (DOD) are discussed in association with these equations. Author

N86-31681# California Univ., Berkeley. College of Engineering.

COHERENT STRUCTURES IN TURBULENT SHEAR LAYERS AND RELATION TO MIXING REACTION AND COMBUSTION Final Report

Apr. 1986 8 p

(Contract N00014-80-C-0694)

(AD-A167042) Avail: NTIS HC A02/MF A01 CSCL 20/4

A number of numerical analyses served as experiments which led to a broad range of ideas about the dynamics of mixing layer. One theme which emerged early was the adversary role of vorticity and of deformation - two quantities which attempt to subjugate each other and whose competition is the subject matter of the development and growth to the shear flow. Another strand of the work follows a number of instabilities (two and three dimensional) which lead to recognizable non-linear motions. A third focus of the work relates vorticity and the mixing of scalars. The work started out to attempt to explain striking experimental results and ended by making a number of predictions which have not yet been experimentally established. A significant fraction, though not all of the typical motions which are dynamically plausible in a shear layer have been examined and given simple analytic representation. Finally the basis for the effective control of the shear layer has been laid. GRA

N86-31682# Aerospace Corp., El Segundo, Calif. Lab. Operations.

PHOTODESORPTION CLEANING OF SILICON WITH VACUUM ULTRAVIOLET IRRADIATION

A. R. Calloway and P. A. Bertrand 4 Apr. 1986 21 p

(Contracts F04701-85-C-0086; F04701-83-c-0084)

(AD-A167420; TR-0086(6766)-1; SD-TR-86-18) Avail: NTIS HC A02/MF A01 CSCL 13/8

An investigation into the use of vacuum-ultraviolet irradiation for photodesorption cleaning of the surface of silicon contaminated by carbonyl and hydrocarbon adsorbates has been made. GRA

N86-31683# Sverdrup Technology, Inc., Arnold Air Force Station, Tenn.

IN-SITU SOLID-PROPELLANT BURN-RATE MEASUREMENTS USING FLASH CINERADIOGRAPHY Final Report, 1 Oct. 1983 - 30 Sep. 1984

R. Y. Walker, R. A. Gamble, and L. M. Smith (Tennessee Univ. Space Inst., Tullahoma) Apr. 1986 45 p Prepared in cooperation with AEDC

(AD-A167637; AEDC-TR-85-22) Avail: NTIS HC A03/MF A01 CSCL 21/8

Flash radiography has been applied to the measurement of solid-propellant burn rates during a series of solid-propellant rocket motor tests at AEDC. This technique offers the advantage of realistic operating conditions and higher data rates than other measurement techniques. The propellant grains were cylindrically perforated and had action times ranging from 2.2 to 3 sec. Four of the six motors were designed to exhibit varying degrees of erosive burning. Chamber pressure and axial thrust were measured on each of the tests. Approximately 25 radiographs (at a rate of 6 per second) were recorded during the tests. These radiographs were subjected to three different methods of image processing. In addition to the quantitative data obtained, many interesting burn anomalies were revealed in the radiographs. GRA

N86-31684# Los Alamos National Lab., N. Mex.

WORKSHOP ON THE FRONTIERS OF THEORETICAL AND EXPERIMENTAL ELECTROCHEMISTRY

S. Gottesfeld, comp., A. Redondo, comp., and R. Lemons, comp. Jan. 1986 35 p Workshop held at Los Alamos, N. Mex., 25 Feb. 1985

(Contract W-7405-eng-36)

(DE86-007188; LA-10606-C; CONF-8502118-Summ) Avail: NTIS HC A03/MF A01

The Workshop on the Frontiers of Theoretical and Experimental Electrochemistry was held at the Los Alamos National Laboratory, February 25 to 26, 1985, to identify those problems and techniques that are at the forefront of electrochemistry research and to generate a summary that will be a guide to the most fruitful areas of electrochemistry research and a foundation for long-term support of such work in this country. Among the conclusions, major advances in understanding electrochemical systems are expected from the application of the new tools for in situ characterization of the solid/electrolyte interface. Parallel thrusts are needed in the areas of theory, experiments on well-defined surfaces, and exploratory research on new interfacial phenomena and new electrode materials. Several specific areas for new research are described in this report. DOE

N86-31685# Sandia National Labs., Albuquerque, N. Mex.

RAMAN SPECTRA OF RINGS IN SILICATE MATERIAL

D. R. Tallant, B. C. Bunker, C. J. Brinker, and C. A. Balfe 1986 7 p Presented at the Materials Research Society Spring Meeting, Palo Alto, Calif., 15 Apr. 1986

(Contract DE-AC04-76DP-00789)

(DE86-009629; SAND-85-2447C; CONF-860445-6) Avail: NTIS HC A02/MF A01

Raman spectroscopic studies on gel-derived silicates have confirmed that narrow bands near 607 cm-1 and 492 cm-1, first observed in the Raman spectrum of fused silica, are associated with three- and four-fold siloxane rings. Using these results, we have identified three- and four-fold siloxane rings in other high-surface-area silica materials, including leached glasses and Cab-O-Sil. This Raman spectroscopic evidence not only shows that small siloxane rings are a common characteristic of a number of silica materials but also suggests that they form preferentially at silica surfaces. This paper reviews the Raman spectroscopic evidence that led to the identification of the vibrational frequencies of the small siloxane rings and presents the results of Raman experiments on high-surface-area silica materials in which the concentration of small siloxane rings is enhanced compared to fused silica. DOE

N86-31686# Illinois Inst. of Tech., Chicago.
THEORETICAL STUDIES OF COMBUSTION DYNAMICS Final Technical Report
J. M. Bowman 1986 4 p
(Contract DE-AC02-81ER-10900)
(DE86-009312; DOE/ER-10900/T3) Avail: NTIS HC A02/MF A01

We developed a novel quantum theory of reactive scattering in which two degrees of freedom are explicitly coupled together and the remaining degrees of freedom are treated in several approximate ways. These approximations have the effect of uncoupling the remaining degrees of freedom from the two which are coupled. Thus, explicit coupling is retained in a reduced dimensionality space. Applications of this theory are discussed and the results are reviewed. A vibrational analysis of polyatomic molecules is included. DOE

N86-31687# California Univ., Berkeley. Lawrence Berkeley Lab.
INTERMITTENCY AND CONDITIONAL VELOCITIES IN PREMIXED CONICAL TURBULENT FLAMES
R. K. Chang and I. G. Shepherd Apr. 1986 20 p Presented at the Spring Meeting of the Western States Section of the Combustion Institute, Alberta, Canada, 28 Apr. 1986 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE86-009363; LBL-21299; CONF-8604144-3) Avail: NTIS HC A02/MF A01

A turbulent premixed ethylene/air conical flame in a large Bunsen type burner has been studied using a two-component laser Doppler anemometry (LDA) system. Conditioned reactant velocity statistics were measured using a silicon oil aerosol, which evaporated and burned through the flame fronts, as the LDA seed. The intermittency was also determined by monitoring the Mie scattering intensity from the aerosol. The unconditioned velocity statistics were measured using aluminum oxide particles. A conditional analysis method was developed to deduce the conditioned product velocities. The method is based on deconvolution of the velocity probability density function (pdf). The difference between the conditioned mean product velocity and the conditioned mean reactant velocity, (DELTA)U, within the oblique region of the Bunsen flame is less than that observed previously in v-shaped premixed turbulent flames. The main reason is that combustion induced flow acceleration is lower for the lean test mixture. The conditioned product rms velocities are almost equal to the conditioned reactant rms velocities meaning that flame generated turbulence is not significant. The unconditioned and conditioned covariance (Reynolds stress) are negligibly small through the flame. Since the flame brush is almost parallel to the burner axis, this result is consistent with the covariances for the v-flames after the data was transformed with respect to the flame co-ordinate. DOE

N86-31688# Lawrence Livermore National Lab., Calif.
ROLE OF THE RADICAL POOL IN COMBUSTION
J. R. Creighton and A. K. Oppenheim 1985 11 p Presented at the 10th International Colloquium on Dynamics of Explosions and Reactive Systems, Berkeley, Calif., 4 Aug. 1985 Prepared in cooperation with California Univ., Berkeley
(Contract W-7405-eng-48)
(DE86-010159; UCRL-91994; CONF-850830-8) Avail: NTIS HC A02/MF A01

We present numerical solutions of the detailed chemical kinetics mechanisms for the reactions of hydrogen with fluorine and oxygen on a phase plane where temperature is plotted vs the concentration of one of the radicals, F or H. We observe that for given initial reactant concentrations, all solutions follow a common path, after an initial transient, regardless of initial temperature of initial radical concentration. We then analyze the reaction mechanism and fine that the rate equations for radical species rapidly reach a stable steady state that couples all of the radicals into a pool. The pool concentration then grow until onset of a reaction that consumes two radicals, resulting in a steady state of the entire pool. Further growth of the pool is due entirely to the temperature dependence of the steady state, which has the form of an equilibrium constant. We show that the rate of temperature increase is proportional to the radical pool concentration, particularly its steady-state value. DOE

N86-31689# Alabama Univ., University. Dept. of Chemistry.
AMBIENT TEMPERATURE LIQUEFACTION USING LIQUID CLATHRATES Quarterly Report, 15 Jan. - 14 Apr. 1986
J. L. Atwood 1986 7 p
(Contract DE-FG22-85PC-80912)
(DE86-010361; DOE/PC-80912/T2; QR-2) Avail: NTIS HC A02/MF A01

One of the more significant advances during the last quarter were observations which lead to an enhanced understanding of the basic liquid clathrate itself. This is a particularly relevant point because there is significant agreement that we can never reach full utility for liquid clathrates in coal liquefaction until we fully understand the liquid clathrate effect. It is well known that liquid clathrates form with a variety of aromatic solvents. Early on we attempted to make a liquid clathrate with 1-methylnaphthalene. This was a desirable choice because of the presence of the aromatic rings which seem to mimic some of the products found in work-ups of more classic coal liquefaction experiments. However, to our surprise 1-methylnaphthalene reacts with liquid clathrate-forming salts to yield a pure one-phase solution. In the course of a detailed examination of this phenomenon, we carried out experiments with 1-methylnaphthalene/toluene mixtures. A variety of different concentrations were utilized. The ones of greatest importance are 20% toluene, 80% 1-methylnaphthalene, 50-50, and 80-20. All of these form liquid clathrates. The ones which have the most toluene form liquid clathrates at room temperature. The one with the least toluene forms a liquid clathrate only at low temperature. For each concentration in the range given above there is a critical change from one phase to two phase behavior with temperature. DOE

N86-31690# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
AROMATICS OXIDATION AND SOOT FORMATION IN FLAMES Progress Report, year beginning 15 Aug. 1985
J. B. Howard 1986 5 p
(Contract DE-FG02-84ER-13282)
(DE86-010585; DOE/ER-13282/2) Avail: NTIS HC A02/MF A01

Kinetics and mechanisms of aromatics oxidation and soot formation in flames are being studied by measuring profiles of soot particle size and number concentration, stable and radical gaseous species concentrations, and temperature in premixed flat flames at 2.67 kPa. Net reaction rates calculated from these measurements are used to test mechanisms of soot formation and oxidation of aromatic species. The technique for measuring radical species is molecular-beam sampling with on-line mass spectrometry, which also provides stable species data. The latter are supplemented by the data from microprobe sampling, and optical methods are being considered for supplementing the H-atom and/or OH-radical measurements. In order to utilize extensive data from previous and current molecular beam mass

spectrometry research in this laboratory, the experimental conditions are chosen to match those of the other work. DOE

N86-31691# Oak Ridge National Lab., Tenn.
DEGRADATION OF MATERIALS IN COMBUSTION ENVIRONMENTS
J. I. Federer, J. M. Robbins, W. P. Parks, Jr., and J. S. Reid 1986 8 p Presented at the 8th Annual Energy Technology Conference, Houston, Tex., 17 Jun. 1986 Prepared in cooperation with Babcock and Wilcox Co., Lynchburg, Va.
(Contract DE-AC05-84OR-21400)
(DE86-011771; CONF-860607-1) Avail: NTIS HC A02/MF A01

Degradation mechanisms in conventional refractories, structural ceramics, and metallic alloys were revealed by examination of materials exposed to industrial and synthetic flue gases. Deterioration of refractory oxides and oxide structural ceramics involved formation of new liquid, glass, and solid phases, which resulted in loss of structural integrity. Destructive stresses associated with volume changes in the case of new solid phases were sometimes increased by thermal cycling. In the case of silicon carbide ceramics the viscosity of the normally protective oxide film was lowered by reaction with alkali oxides, which resulted in enhanced oxygen diffusion and active oxidation. Silicon carbide was also attacked by halide-containing atmospheres. Degradation was also caused by excessive temperatures, thermal cycling, and stresses caused by adhering slags. Several types of degradation mechanisms were observed in metallic alloys including breakaway oxidation, intergranular oxidation and attack, and sulfidation-oxidation. DOE

N86-31692# Kiruna Geophysical Inst. (Sweden).
A NEW WAY OF ORGANIZING SPECTRAL LINE RATIO FLUCTUATIONS
Bo Thelin Oct. 1985 17 p
(KGI-Preprint-084; ISSN-0349-2656; ESA-86-97223) Avail: NTIS HC A02/MF A01

An analysis method of organizing spectral line ratio fluctuations was developed to see which line pair of analysis is more or less stable at repeated measurements. A linear graph is obtained for iron lines when the spectral line ratio fluctuations were plotted versus the photon energies of these lines. When these fluctuations were plotted versus the upper energies instead, no linear structure is obtained. This means that there is no linearity with the conventional intensity formula with the Boltzmann exponent, but there is if exp (-h nu sub mn/kT) is used. The same result is achieved on absolute intensities of iron lines using intensity tables from direct current arc measurements with photographic registration. ESA

N86-31693# Endress und Hauser G.m.b.H. und Co., Maulburg (West Germany). Bereich Forschung und Entwicklung.
MOISTURE MEASUREMENT IN SOLIDS Final Report, Jan. 1985
Walter Borst, Rainer Herrmann, Rainer Silbermann, and Dieter Trefzer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 71 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-174; ISSN-0340-7608; ESA-86-97446) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15

A system using the damping of microwave radiation was developed for the measurement of the moisture content of solids in industrial applications. For the microwave part a compensating principle was selected, and the circuit was optimized with respect to sensitivity, high dynamic range, and temperature stability. Algorithms for the moisture content dependence on the damping factor were derived; they take into account temperature and density of the material as well as standing wave effects of the microwave arrangement. In laboratory tests with prototypes the algorithms were confirmed, and the influence of disturbances was successfully compensated. ESA

N86-31694# Battelle Inst., Frankfurt am Main (West Germany).
REMOTE GAS ANALYSIS WITH LASERS. ANALYTIC LABORATORY INVESTIGATIONS IN THE 3.4 TO 4.2 MICRONS RANGE Final Report, Jul. 1980
Joerg Boscher and Wolfgang Diehl Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1985 186 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-020; ISSN-0170-1339; ESA-86-97484) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35

The absorption spectra of methane, ethane, propane, isobutane, n-butane, proprene 1, 1-butene, methyl chloride and hydrogen chloride were measured with lead salt diode laser spectrometers with respect to wavelength, pressure, and temperature. The measurements were analyzed to evaluate the accuracy and the applications of the spectrometer. Doppler-propagated spectra at low pressures in pure gases and shock-propagated spectra in mixed gases with synthetic air at variable pressures were measured. The spectra are classified by spectral line density, individual line force and width. The gases are classified into three groups according to their spectral structure. The value of the absorption factor determines the applicability of differential absorption spectrometry. The high resolution diode laser spectrometer should be used to measure individual line structure only. ESA

N86-31695# European Space Agency, Paris (France).
MODEL FOR NORMAL AND EROSIVE BURNING OF COMPOSITE PROPELLANTS
Jean-Claude Godon Dec. 1985 186 p Original language document was announced as N85-24024
(ESA-TT-910; ONERA-NT-1984-3; ESA-86-97798) Avail: NTIS HC A09/MF A01

Processes governing the normal combustion of composite propellants, and the causes of the erosive burning phenomenon are discussed. Analytical expression of the combustion mechanisms leads to the construction of numerical models describing the autonomous combustion of ammonium perchlorate and the normal combustion of composite propellants. A first coupling with a calculation for a turbulent boundary layer with wall injection gives an evaluation of the intensification of combustion in erosive conditions, due to the existence of a high specific mass flow rate sweeping the surface. Each model is based on experimental data or data from the literature. Results show good agreement with experimental data. ESA

N86-31696# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain). Dept. de Petroleo, Materiales Functionales y Protectivos.
LIQUID CHROMATOGRAPHY ANALYSIS OF ESTER TYPE SYNTHETIC LUBRICANTS [ANALISIS POR CROMATOGRAFIA LIQUIDA DE LUBRICANTES SINTETICOS TIPO ESTER]
M. C. Gutierrez and L. Aliste 1985 20 p In SPANISH
(ESA-86-97811) Avail: NTIS HC A02/MF A01

A chromatographic analytical method is described. The method is adapted to a Waters modular instrument and an absorption infrared spectrophotometer. The measurement parameters are described and several examples are presented. It is shown that the combination of inverted phase and classic column procedures gives the best possibility to solve analytical problems. ESA

N86-31697# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
CHARACTERIZATION OF CELLULOSE NITRATE WITH LIQUID CHROMATOGRAPHY AND MEMBRANE OSMOMETRY
Anders Wirsen and Eyvind Helleday Feb. 1986 35 p In SWEDISH; ENGLISH summary
(FOA-C-20602-D1; ISSN-0347-3694; ESA-86-97858) Avail: NTIS HC A03/MF A01

Cellulose nitrate (CN) of varying molecular weight, nitration, and molecular weight distribution was studied. The average molecular weights were determined on line with a low angle laser detector (LALLS) and the degree of nitration with an infrared detector, both in combination with a concentration detector

(differential refractometer). The molecular weight data were in good agreement with static LALLS and membrane osmometry on unfractioned samples. Qualitative correlation with viscosimetry was observed. The degree of nitration was accurately determined for pure CN as well as for CN in propellants. ESA

N86-32358*# Lawrence Livermore National Lab., Calif.
PRODUCTION RATES OF NEON XENON ISOTOPES BY ENERGETIC NEUTRONS
D. A. Leich, R. J. Borg, and V. B. Lanier *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 07D

N86-32361*# Los Alamos National Lab., N. Mex.
RESONANCE IONIZATION MASS SPECTROMETRY FOR ISOTOPIC ABUNDANCE MEASUREMENTS
C. M. Miller *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-31698*# McDonnell-Douglas Research Labs., St. Louis, Mo.
STUDY ON EFFECTS OF POWDER AND FLAKE CHEMISTRY AND MORPHOLOGY ON THE PROPERTIES OF Al-Cu-Mg-X-X-X POWDER METALLURGY ADVANCED ALUMINUM ALLOYS Final Report
P. J. Meschter, R. J. Lederich, and J. E. ONeal Aug. 1986 74 p (Contract NAS1-17107)
(NASA-CR-178145; NAS 1.26:178145) Avail: NTIS HC A04/MF A01 CSCL 11F

A study was conducted: (1) to develop rapid solidification processed (RSP) dispersoid-containing Al-3Cu-2Li-1Mg-0.2Zr alloys as substitutes for titanium alloys and commercial 2XXX aluminum alloys for service to at least 150 C; and (2) to develop RSP Al-4Li-Cu-Mg-Zr alloys as substitutes for high-strength commercial 7XXX alloys in ambient-temperature applications. RSP Al-3Cu-2Li-1Mg-0.2Zr alloys have density-normalized yield stresses at 150 C up to 52% larger than that of 2124-T851 and up to 30% larger than that of Ti-6Al-4V. Strength at 150 C in these alloys is provided by thermally stable delta' (Al3Li), T1 (Al2LiCu), and S' (Al2CuMg) precipitates. Density-normalized yield stresses of RSP Al-3Cu-2Li-1Mg-0.2Zr alloys are up to 100% larger than that of 2124-T851 and equivalent to that of Al-8Fe-4Ce at 260 C. Strength in the RSP alloys at 260 C is provided by incoherent dispersoids and subboundary constituent particles such as T1 and S. The RSP alloys are attractive substitutes in less than or = 100-h exposures for 2xxx and Al-4Fe-Ce alloys up to 260 C and for titanium alloys up to 150 C. RSP Al-4Li-Cu-Mg-Zr alloys have ambient-temperature yield and ultimate tensile stresses similar to that of 7050-T7651, and are 14% less dense. RSP Al-4Li-0.5Cu-1.5Mg-0.2Zr has a 20% higher specific yield stress, 40% higher specific elastic modulus, and superior corrosion resistance compared to the properties of 7050-T7651. Strength in the Al-4Li-Cu-Mg-Zr alloy class is primarily provided by the substructure and delta' precipitates and is independent of Cu:Mg ratio. Improvements in fracture toughness and transverse-orientation properties in both alloy classes depend on improved melt practices to eliminate oxide inclusions which are incorporated into the consolidated forms. Author

N86-31699*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE LOW CYCLE FATIGUE BEHAVIOR OF A PLASMA-SPRAYED COATING MATERIAL
John Gayda, Timothy P. Gabb, and Robert V. Miner, Jr. 1986 17 p Presented at the 1986 TMS-AIME Annual Meeting, New Orleans, La., 2-6 Mar. 1986
(NASA-TM-87318; E-3050; NAS 1.15:87318) Avail: NTIS HC A02/MF A01 CSCL 11F

Single crystal nickel-base superalloys employed in turbine blade applications are often used with a plasma spray coating for oxidation and hot corrosion resistance. These coatings may also affect fatigue life of the superalloy substrate. As part of a large program to understand the fatigue behavior of coated single crystals, fully reversed, total strain controlled fatigue tests were run on a free standing NiCoCrAlY coating alloy, PWA 276, at 0.1 Hz. Fatigue tests were conducted at 650 C, where the NiCoCrAlY alloy has modest ductility, and at 1050 C, where it is extremely ductile, showing tensile elongation in excess of 100 percent. At the lower test temperature, deformation induced disordering softened the NiCoCrAlY alloy, while at the higher test temperature cyclic hardening was observed which was linked to gradual coarsening of the two phase microstructure. Fatigue life of the NiCoCrAlY alloy was significantly longer at the higher temperature. Further, the life of the NiCoCrAlY alloy exceeds that of coated, /001/-oriented PWA 1480 single crystals at 1050 C, but at 650 C the life of the coated crystal is greater than that of the NiCoCrAlY alloy on a total strain basis. Author

N86-31700*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROSTRUCTURE-PROPERTY RELATIONSHIPS IN DIRECTIONALLY SOLIDIFIED SINGLE CRYSTAL NICKEL-BASE SUPERALLOYS
Rebecca A. MacKay and Michael V. Nathal 1986 37 p Presented at MiCon 1986: Optimization of Processing, Properties and Service Performance through Microstructural Control, Philadelphia, Pa., 15-16 May 1986; sponsored by ASTM
(NASA-TM-88788; E-3122; NAS 1.15:88788) Avail: NTIS HC A03/MF A01 CSCL 11F

Some of the microstructural features which influence the creep properties of directionally solidified and single crystal nickel-base superalloys are discussed. Gamma precipitate size and morphology, gamma-gamma lattice mismatch, phase instability, alloy composition, and processing variations are among the factors considered. Recent experimental results are reviewed and related to the operative deformation mechanisms and to the corresponding mechanical properties. Special emphasis is placed on the creep behavior of single crystal superalloys at high temperatures, where directional gamma coarsening is prominent, and at lower temperatures, where gamma coarsening rates are significantly reduced. It can be seen that very subtle changes in microstructural features can have profound effects on the subsequent properties of these materials. M.G.

N86-31701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CONTINUING BATTLE AGAINST DEFECTS IN NICKEL-BASE SUPERALLOYS
Robert L. Dreshfield 1986 27 p Presented at the 115th TMS Annual Meeting, New Orleans, La., 2-6 Mar. 1986; sponsored by AIME
(NASA-TM-87343; E-3092; NAS 1.15:87343) Avail: NTIS HC A03/MF A01 CSCL 11F

In the six decades since the identification of age hardenable nickel-base superalloys their compositions and microstructures have changed markedly. Current alloys are tailored for specific applications. Thus their microstructures are defined for that application. This paper briefly reviews the evolution of superalloy microstructures and comments on the appearance and implications of microstructural defects in high performance superalloys. It is seen that new alloys and processes have generated new types of defects. Thus as the industry continues to develop new alloys and processes it must remain vigilant toward the identification and control of new types of defects. Author

N86-31702*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF VARIATIONS OF COBALT CONTENT ON THE CYCLIC OXIDATION RESISTANCE OF SELECTED NI-BASE

SUPERALLOYS
Charles A. Barrett Mar. 1986 24 p Presented at the Annual Meeting of the Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, New Orleans, La., 2-6 Mar. 1986
(NASA-TM-87297; E-2952; NAS 1.15:87297) Avail: NTIS HC A02/MF A01 CSCL 11F

Cobalt levels were systematically varied in the Ni-base turbine alloys U-700 (cast), U-700m(PM/HIP), Waspaloy, Mar-M-247, In-738, Nimonic-115, U-720, and SX-R-150. The cobalt levels ranged from 0 wt % to the nominal commercial content in each alloy. The alloys were tested in cyclic oxidation in static air at 1000, 1100 and 1150 C for 500, 200 and 100 hr respectively. An oxidation attack parameter, Ka derived from the specific weight change versus time data was used to evaluate the oxidation behavior of the alloys along with X-ray diffraction analysis of the surface oxides. The alloys tend to form either Cr2O3/chromite spinel or Al2O3/aluminate spinel depending on the CR/Al ratio in the alloys. Alloys with a ratio of 3.5 or higher tend to favor the Cr oxides while those under 3.0 form mostly Al oxides. In general the Al2O3/aluminate spinel forming alloys have the better oxidation resistance. Increased cobalt content lowers the scaling resistance of the higher Cr alloys while a 5.0 wt % Co content is optimum for the Al controlling alloys. The refractory metals, particularly Ta, appear beneficial to both types of oxides perhaps due to the formation of the omni-present tirutile Ni(Ta,Cb,Mo,W)2O6. Both scales break down as increasing amounts of NiO is formed.
Author

N86-31703# Army Armament Research and Development Command, Watervliet, N. Y. Close Combat Armaments Center.
MECHANICAL PROPERTY DEVELOPMENT IN HOT ISOSTATIC PRESSED (HIP) LOW ALLOY STEEL POWDER Final Technical Report
Peter Thornton, John Senick, and John Atchinson Jan. 1986 25 p
(AD-A166666; AD-E440316; ARCCB-TR-86005) Avail: NTIS HC A02/MF A01 CSCL 11/6

The mechanical properties of a low alloy steel gas atomized powder, which was hot isostatically pressed (Hipped) to full density, were developed using typical commercial heat treatment practices. Tempering temperatures were varied systematically from 1000 F to 1200 F and the tensile and impact properties evaluated along with the corresponding microstructural conditions. Yield strengths on the order of 180,000 psi accompanied by low temperature, impact toughness values of 18-20 ft-lb were developed in billets of this material, 4 inches in diameter. The results of this study demonstrate that hot isostatic pressing of low alloy steel powder can be utilized to produce high quality components for critical applications which will benefit from near-net shape manufacturing techniques. GRA

N86-31704# Department of the Navy, Washington, D. C.
WEAR IMPROVEMENT IN TITANIUM ALLOYS BY ION IMPLANTATION Patent
Ronald G. Vardiman, Inventor (to Navy) Issued 4 Feb. 1986 5 p Supersedes AD-D011694
(AD-D012203; US-Patent-4,568,396; US-Patent-Appl-SN-657115; US-Patent-Class-148/133) Avail: US Patent and Trademark Office CSCL 11/6

This invention relates to a method of making titanium alloy more resistant to sliding wear and fretting fatigue comprising the steps of: implanting carbon ions with at least one energy onto titantium alloy until at least 1 x 10 to the 17th power carbon ions/sq. cm have fallen onto the titanium alloy, said energy level of carbon ions being implanted being greater than 10 KeV. A second method comprises an additional step of heating the implanted titanium alloy to between 300 C. and 500 C. for 0.5 hours to 2 hours. The second method has a lower number of carbon ions/sq. cm implanted onto the titanium. GRA

N86-31705# Naval Ship Research and Development Center, Annapolis, Md. Ship Materials Engineering Dept.
THE INFLUENCE OF INCUBATION TIME ON THE PASSIVE FILM BREAKDOWN OF ALUMINUM ALLOYS IN SEAWATER
Denise M. Aylor and Patrick J. Moran Apr. 1986 22 p
(AD-A167398; DTNSRDC/SME-86-11) Avail: NTIS HC A02/MF A01 CSCL 11/6

Potential-controlled electrochemical methods were used to charactertze the pitting behavior of 6061 alloy aluminum in synthetic ocean water. Irreproducible breakdown potentials (E sub bd) and reproducible repassivation potentials (E sub rp) were determined from cyclic anodic polarization (CAP). Reproducible breakdown and repassivation potentials were found from the quasi-stationary anodic polarization method; however, the breakdown potential values were shifted in the electronegative direction relative to the CAP method due to the allowance of a longer incubation time. These results support the theory that with sufficient incubation time, pit initiation and propagation will occur at potentials at or slightly above the repassivation potential, and that the repassivation potential value is the only characteristic potential for aluminum. The quasi-stationary anodic polarization method used for E sub rp determination provides a reproducible electrochemical method for obtaining E sub rp after minimal pit growth or surface damage. Cyclic anodic polarization can also be used for determining a representative potential if surface damage subsequent to pit initiation is minimized. GRA

N86-31706# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
ADVANCED PROCESSING AND PROPERTIES OF HIGH PERFORMANCE ALLOYS
D. A. Koss 25 Mar. 1986 19 p
(Contract N00014-85-K-0427)
(AD-A167404; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/6

Progress is reviewed for a research program whose primary purpose is to establish a fundamental understanding of the applications and consequences of selected advanced processing techniques to high performance alloys. The broadly-ranged research effort includes studies of powder processing (hot isostatic pressing), fracture of alloys containing processing-induced defects (porosity), and application of advanced processing techniques to high performance alloys (rapidly solidified, dispersion-strengthened titanium alloys). Many aspects of the program also constitute fundamental studies of deformation and fracture utilizing engineering alloys containing processing-induced defects. Progress for the period October 1, 1985 to December 31, 1985 is reviewed for the following parts of the research program: the influence of void/pore distributions on fracture, hot isostatic pressing of metallic powders, deformation of rapidly solidified Ti alloys at elevated temperatures, and strain-path effects and the combined influence of stress state and grain size on the fracture of alloys containing hydrides. GRA

N86-31707# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND CHARACTERIZATION OF NICKEL SUBSTITUTED Fe5C2
Z-D. Zhang, R. Kershaw, K. Dwight, and A. Wold 12 May 1986 8 p
(Contract N00014-86-K-0234)
(AD-A167410; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/2

Nickel can be substituted into Fe5C2 to the extent of 20 atomic percent. Samples were prepared by codecomposition of mixed nitrates followed by reduction at 290 C in a 9:1 H2:CO atmosphere. Confirmation of the limit of substitution was made by both magnetic and X-ray analysis. It has been shown by a number of investigators that the catalytic activity of iron catalysts, used to reduce CO by hydrogen, was related to the extent of carbide formation. Fournier et al. reported that the phases Fe5C2 and Fe were detectable both from X-ray diffraction patterns and from thermomagnetic curves taken from products which were quenched after 10 minutes of reaction time (at maximum activity). It was shown that the active catalysts formed from both Fe2O3 and metallic iron contain Fe5C2. Catalyst deactivation is most probably associated with unreactive graphite which is formed during the methanation process. There have been no reports concerning the crystallographic or magnetic properties of the system Fe5-xNixC2. Since Fe5C2 shows a Curie

point at 246 C, any substitution of nickel into the phase could be determined by changes in the Curie point. Furthermore, the optimum solubility of nickel into Fe5C2 could be determined from X-ray diffraction studies of members of the system Fe5-xNixC2. Since pure nickel does not appear to carbide under Fisher-Tropsch conditions, it should be present as a separate phase when maximum solubility is achieved. GRA

N86-31708# Naval Postgraduate School, Monterey, Calif.
THE VARIATION OF THE DISLOCATION DENSITY IN ALUMINUM DEFORMED TO LARGE STEADY-STATE CREEP STRAINS M.S. Thesis
Timothy S. Wetter Mar. 1986 56 p
(AD-A167715) Avail: NTIS HC A04/MF A01 CSCL 11/6

This thesis reports trends in the variation of the subgrain size and density of dislocations not associated with subgrain boundaries (forest dislocations) in high purity aluminum with strain during primary and steady-state creep at temperatures in the power-law regime utilizing torsional deformation. Any microstructural feature responsible for strength is expected to be constant during steady-state deformation. Earlier work addressed changes in the subgrain size over a wide range of steady-state strain. A constant subgrain size was found. The present effort primarily examined the dislocation density but also further evaluated the conclusion of a constant subgrain size during steady-state. The subgrain size data were found consistent with the earlier work. In contrast to constant-stress tests in other investigations, it was found, here, that the forest dislocation density monotonically increased until a steady-state at a strain of approximately 0.20. The forest dislocation density is essentially constant at steady-state. These two findings are consistent with dislocation network theories for creep. Optical micrographs were taken from tangential sections of the torsion samples, which substantiated the finding that the subgrain size is fixed during steady-state. GRA

N86-31709# Worcester Polytechnic Inst., Mass. Dept. of Mechanical Engineering.
CHARACTERIZATION OF ION IMPLANTED AND LASER PROCESSED WEAR SURFACES Final Report, 1 Dec. 1984 - 28 Feb. 1986
Sara A. Dillich 22 Apr. 1986 52 p
(Contract N00014-85-K-0066)
(AD-A167878) Avail: NTIS HC A04/MF A01 CSCL 20/11

SEM/EDX (Scanning Electron Microscopy/Energy Dispersing X Ray Analysis) and scanning Auger microscope analysis were employed to characterize wear surfaces and debris on friction tested, laser processed metal-carbide composite surfaces. The friction and wear of the composite samples were found to be influenced by the compatibility (degree of mutual solubility) of the carbides with the steel counterface, as well as by local inhomogeneities in the carbide distribution. High fluence Ti implantation resulted in increased friction and wear, possibly due to an implantation induced softening or degradation of the carbides. Cavitation erosion tests were performed on nonimplanted and ion implanted samples of a Co based hardface alloy (Stoody 3). Erosion of the test samples was found to initiate by debonding at the carbide-matrix interfaces and by crack propagation through the carbides. The erosion mechanisms in the alloy were altered by both N and Ti implantations. Ti implantation, in particular, appeared to significantly increase the erosion resistance of the alloy. TEM (Transmission Electron Microscopy) studies were made on nonimplanted and ion implanted foils of Stoody 3, to investigate structural changes induced by implantation. Ti implantation produced a surface layer with an amorphous matrix phase and recrystallized carbides, while N implantation greatly increased the stacking fault density in the matrix phase. GRA

N86-31710# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
TO WHAT EXTENT ARE GRAIN BOUNDARIES IN METALS ORDERED STRUCTURES
R. W. Balluffi Sep. 1985 13 p
(Contract DE-FG02-84ER-45116)
(DE86-007004; DOE/ER-45116/9) Avail: NTIS HC A02/MF A01

It appears likely on the basis of present information that the structural unit/grain boundary dislocation model is applicable to all types of boundaries (short and long period, tilt, twist and mixed) at low temperatures (T less than T(sub m)/3). Such boundaries therefore consist of ordered arrays of various types of structural units which are generally systematically distorted to at least some extent over the boundary areas. These arrays obey a crystallography dictated by the base vectors of the units and the boundary periodicities. This ordered framework is not affected by a possible multiplicity of the units. The less extensive (and more contradictory) information available at high temperatures (T greater than T(sub m)/3) suggests that this same model is again generally applicable for at least many boundaries up to essentially T(sub m). However, increasing disorder in the form of increasing structural unit multiplicity and increasing vibrational amplitudes and anharmonicity may be expected. The possibility that more extensive disordering transitions occur well below T(sub m) in some boundaries (particularly long period boundaries with complex unit structures) cannot be precluded. DOE

N86-31711# Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil).
CORROSION BEHAVIOUR OF ALUMINIUM PLATES IN AQUEOUS MEDIUM
M. F. deOliveira and J. C. Gaio 1985 9 p In PORTUGUESE Presented at the 12th National Seminar on Corrosion, Salvador, Brazil, 13 May 1985
(DE86-701575; INIS-BR-431; CONF-8505227-2) Avail: NTIS (US Sales Only) HC A02/MF A01

The process of corrosion of aluminum 1050 plate was studied at room temperature, 45 to 60 C, in deionized water from the Argonauta Reactor Water. In addition to the influence of temperature, the effect of chloride ions and oxygen were also verified. It was found that the amount of oxide formed at room temperatures is almost negligible. It was observed that there is risk of corrosion in the case of Reactor Water contaminated with chloride ions. The results have shown that the aluminum can be used since the medium is not strongly oxidizing. At potentials higher than - 900M sup(V) ess (-280 m sup(V) sub(H)), the material will undergo pitting corrosion. DOE

N86-31712# Oak Ridge National Lab., Tenn.
ANALYSIS OF HEAT-AFFECTED ZONE CRACKING IN NI3AI ALLOYS
M. L. Santella, M. C. Maguire, and S. A. David 1986 4 p Presented at the 67th Annual American Welding Society Meeting, Atlanta, Ga., 13 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-009449; CONF-8604123-2) Avail: NTIS HC A02/MF A01

A key issue in the development of Ni3Al for engineering applications is their weldability. Detailed welding studies have been done which show that iron-containing nickel aluminides are prone to heat-affected zone (HAZ) cracking. Hot ductility testing of these alloys has suggested that grain boundary cohesive strength controls high temperature ductility and the resistance to HAZ cracking. This analysis cannot, however, be used to explain the behavior of other aluminide alloys. The intention of this work is to more fully characterize the relationship between mechanical behavior and HAZ cracking susceptibility for Ni3Al alloys. DOE

N86-31713# Oak Ridge National Lab., Tenn.
IN-VACUUM CYCLIC FATIGUE BEHAVIOR OF VANSTAR-7 AT ELEVATED TEMPERATURES
K. C. Liu 1986 6 p Presented at the American Nuclear Society Annual Meeting, Reno, Nev., 15 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-007322; CONF-860610-21) Avail: NTIS HC A02/MF A01

Refractory metal alloys have been proposed for fusion reactor and space power applications because of their high temperature strength, low thermal stress properties, good compatibility with liquid metal coolants and radiation resistance. However, little is known about the cyclic fatigue properties which are important to

some fusion reactor first wall systems that operate in thermal cycles. This paper presents limited results of in-vacuum cyclic fatigue tests on Vanstar-7 (9Cr-3Fe-Zr) at room temperature, 550 and 650(0)C. Miniature hourglass-shaped specimens were used with a gage diameter of 3.18 mm. The material was annealed 1 h in vacuum at 1400(0)C before machining, to produce an average grain size of ASTM No. 7. The specimens were stress relieved for 0.5 h at 1400(0)C after machining. Tests were performed on a servocontrolled hydraulic testing system equipped with a vacuum chamber capable of pressures below 10(-5) Pa. Specimens were heated by an induction heater, maintaining temperatures within +-2(0)C of the nominal temperature during the test. A diametral extensometer was used, but axial strain calculated via a strain computer was used for machine control. A fully reversed triangular wave function beginning with compression was employed at a strain rate of 4 x 10(-3) s(-1) for all low-cycles tests. High cycle testing was conducted initially in strain control but switched to load control after stable essentially elastic cycling was established. DOE

N86-31714# Los Alamos National Lab., N. Mex.
MECHANICAL PROPERTIES TESTING OF SEVERAL 800 MeV PROTON IRRADIATED BCC METALS AND ALLOYS
R. D. Brown, M. S. Wechsler, and C. Tschalaer 1986 25 p Presented at the 13th International Symposium on the Effects of Radiation on Materials, Seattle, Wash., 23 Jun. 1986 Prepared in cooperation with Iowa State Univ. of Science and Technology, Ames and Schweizerisches Inst. fuer Nuklearforschung, Villigen
(Contract W-7405-eng-36)
(DE86-007372; LA-UR-86-733; CONF-860605-4) Avail: NTIS HC A02/MF A01

A spallation neutron source for the 600-MeV proton accelerator facility at the Swiss Institute for Nuclear Research (SIN) consists of a vertical cylinder filled with molten Pb-Bi. The proton beam enters the cylinder, passing upward through a window in contact with the Pb-Bi eutectic liquid. Investigations are underway at the 800-MeV proton accelerator at LAMPF to test the performance of candidate SIN window materials. Based on considerations of chemical compatibility with molten Pb-Bi, as well as radiation damage mechanisms, Fe, Ta, Fe-2.25Cr-1Mo, and Fe-12Cr-1Mo (Ht-9) were chosen as candidate materials. Sheet tensile samples were sealed inside capsules containing Pb-Bi and were proton-irradiated at LAMPF to two fluences, 4.8 and 54 x 10(23) p/m(2). The beam current was approximately equal to the 1 mA anticipated for the upgraded SIN accelerator. Yield and ultimate strengths increased upon irradiation in all materials, while the ductility decreased. The pure metals, Ta and Fe, exhibited the greatest radiation hardening and embrittlement. The HT-9 alloy showed the smallest changes in strength and ductility. DOE

N86-31715# Argonne National Lab., Ill.
RADIATION-INDUCED SEGREGATION AND PRECIPITATION IN MOLYBDENUM-RHENIUM ALLOYS
R. A. Erck, C. M. Wayman, and L. E. Rehn Feb. 1986 20 p Presented at the 13th International Symposium on the Effects of Radiation on Materials, Seattle, Wash., 23 Jun. 1986 Prepared in cooperation with Illinois Univ., Urbana
(Contract W-31-109-eng-38)
(DE86-007521; CONF-860605-6) Avail: NTIS HC A02/MF A01

Specimens of Mo-7 at. % Re and Mo-30 at. % Re were irradiated with 1.8 MeV (4)He(+) ions at elevated temperatures. Radiation-induced segregation of Re was measured during irradiation by in situ Rutherford backscattering spectrometry. Segregation of the undersized Re atoms in the same direction as the defect fluxes, i.e., toward the external surface, was observed. The amount of Re enrichment in the near-surface region was measured as a function of temperature and of dose at a calculated near-surface displacement rate near 1 x 10(-4)dpa/s. Segregation was observed at temperatures from 800 to 1500(0)C in Mo-7Re, and from 850 to 1225(0)C in Mo-30Re. Irradiated disks were examined by transmission electron microscopy. Precipitates of Chi phase were observed on grain boundaries, or in a thin layer at the irradiated surface in Mo-30Re after irradiation at temperatures from 750 to 1075(0)C. Frequently, Chi precipitates formed with a crystallographic twin orientation with respect to the host matrix. No voids were observed for doses up to 1.6 dpa. DOE

N86-31716# Oak Ridge National Lab., Tenn.
EFFECT OF NEUTRON IRRADIATION ON THE TENSILE PROPERTIES AND MICROSTRUCTURE OF SEVERAL VANADIUM ALLOYS
D. N. Braski 1986 34 p Presented at the 13th International Symposium on the Effects of Radiation on Materials, Seattle, Wash., 23 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008234; CONF-860605-9) Avail: NTIS HC A03/MF A01

Specimens of V-15Cr-5Ti, VANSTAR-7, and V-3Ti-1Si were encapsulated in TZM tubes containing (7)Li to prevent interstitial pickup and irradiated in FFTF (MOTA experiment) to a damage level of 40 dpa. The irradiation temperatures were 420, 520, and 600(0)C. For a better simulation of fusion reactor conditions, helium was preimplanted in some specimens using a modified version of the tritium trick. The V-15Cr-5Ti alloy was most susceptible to irradiation hardening and helium embrittlement, followed by VANSTAR-7 and V-3Ti-1Si. VANSTAR-7 exhibited a relatively high maximum void swelling of approx. 6% at 520(0)C while V-15Cr-5Ti and V-3Ti-1Si had values of less than 0.3% at all three temperatures. The V-3Ti-1Si clearly outperformed the other two vanadium alloys in resisting the effects of neutron irradiation. DOE

N86-31717# Oak Ridge National Lab., Tenn.
ION DAMAGE MICROSTRUCTURES IN A Fe-10Cr-6Mo-0.5Nb
K. Farrell and E. H. Lee 1986 20 p Presented at the 13th International Symposium on the Effects of Radiation on Materials, Seattle, Wash., 23 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008500; CONF-860605-11) Avail: NTIS HC A02/MF A01

An annealed-and-aged ferritic steel containing fine NbC precipitates and relatively coarse particles of Laves phase was bombarded with 4-MeV iron ions to 100 displacements per atom (dpa) at 400 to 600(0)C. Much of the damage structure consisted of dislocation tangles that coarsened with increasing temperature. Cavity formation began at 450(0)C, peaked at 500 to 550(0)C and was absent at 600(0)C. Maximum swelling was only 0.2%. The Laves particles exhibited recoil dissolution and restructuring. Bombardments with Fe + He + D or Fe + He beams at ratios of 10 atomic parts per million (appM) He/dpa and 45 appM D/dpa introduced high concentrations of very small bubbles and comparatively few larger, bias-driven cavities. The latter were initiated at bubble clusters on NbC particles. Maximum swelling of 0.75% occurred at 550(0)C. Recoil dissolution of the Laves phase was retarded by the gases. Large critical cavity sizesand unbalanced dislocation and cavity sink strengths contribute to low swelling of this alloy. DOE

N86-31718# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN OF TOUGH FERRITIC STEELS FOR CRYOGENIC USE
J. W. Morris, Jr. Oct. 1985 39 p Presented at the Symposium on Structure/Property Relationships, New Orleans, La., 3 Mar. 1986
(Contract DE-AC03-76SF-00098)
(DE86-009361; LBL-20485; CONF-8603110-1) Avail: NTIS HC A03/MF A01

This paper describes the design of ferritic steels and weldments that combine strength and toughness at cryogenic temperatures. The alloy must have a ductile-brittle transition temperature below the intended service temperature and a high fracture toughness in the ductile mode. Its systematic design uses the microstructure-property relations that govern the transition temperature and fracture toughness to identify a suitable microstructure, and then employs the microstructure-processing relations that govern its thermal response to manipulate the microstructure into the appropriate form. The procedure is illustrated by describing the heat treatments, microstructures and properties of a variety of laboratory and commercial alloys, including conventional 9Ni steel, the low-Ni and Fe-Mn ferritic steels that have been developed as

an alternative to 9Ni, the 12Ni steels that are promising for use at 4K, and the welding procedures and ferritic filler metals that are useful for ferritic cryogenic steels. DOE

N86-31719# Hanford Engineering Development Lab., Richland, Wash.
INSIGHTS INTO THE FRACTURE TOUGHNESS OF MARTENSITIC STAINLESS STEELS USING STEREOSCOPIC FRACTOGRAPHIC MEASUREMENTS
D. S. Gelles Aug. 1985 5 p Presented at the Fundamental Aspects of Fracture, Gatlinburg, Tenn., 4 Nov. 1985
(Contract DE-AC06-76FF-02170)
(DE86-009415; HEDL-SA-3291; CONF-851104-2) Avail: NTIS HC A02/MF A01

Stereoscopic fractographs of precracked compact tension and precracked miniature Charpy specimens can provide critical crack opening displacements (delta/sub c/) on a microstructural scale. The critical crack opening displacement can be related to the critical crack extension force (G/sub c/) by the Wells relationship G/sub c/ = n sigma/sub y/ delta/sub c/ where n is the plastic stress intensity factor and sigma/sub y/ is the yield stress. This approach has been used to examine the fracture behavior of two martensitic stainless steels. Examinations on a microstructural scale were compared with J/sub Ic/ measurements in order to assess the validity of the Wells relationship. It was found that the two modes of crack extension, stretching and crack propagation, were clearly defined but that an intermediate stage also occurred. This intermediate stage was a precursor to crack propagation but differed from crack propagation in that crack tip blunting eventually slowed propagation and returned extension to the stretching mode. This intermediate stage is very localized, creates a unique fracture appearance and produces uncertainty in the determination of a precise value for J/subIc/. DOE

N86-31720# Oak Ridge National Lab., Tenn.
INFLUENCE OF RADIATION-INDUCED SEGREGATION ON DUCTILITY OF A NICKEL-SILICON ALLOY
N. H. Packan, H. Schroeder, and W. Kesternich 1986 17 p Presented at the 2nd International Conference on Fusion Reactor Materials (ICFRM-2), Chicago, Ill., 13 Apr. 1986 Prepared in cooperation with Kernforschungsanlage Juelich G.m.b.H., West Germany
(Contract DE-AC05-84OR-21400)
(DE86-009500; CONF-860421-26) Avail: NTIS HC A02/MF A01

Flat tensile specimens 60 microns thick of Ni-6 at. % Si were irradiated to bulk damage levels of 0.1 to 0.3 dpa with either 7 MeV protons or 28 MeV alpha particles at 750 K. The alpha bombarded specimens incurred 750 at. ppM He per 0.1 dpa in the course of their damage-generating irradiation. Radiation-induced silicon segregation gave rise to Ni3Si layers at internal and external surfaces. Postirradiation tensile tests conducted either at 300 K or 720 K revealed fully ductile (chisel-edged) transgranular fracture profiles. There were no significant differences between the proton-bombarded specimens and the unbombarded controls, both exhibiting greater than 25% total elongations, while the alpha-bombarded specimens showed ductile fractures with somewhat lower (17 to 18%) elongation values probably due to hardening caused by small helium bubbles. Certain specimens that were preimplanted with 250 to 1000 at. ppM He at 970 K to encourage intergranular failure and expose grain boundaries did fail intergranularly. It is concluded that radiation-induced silicon segregation does not cause intrinsic embrittlement. DOE

N86-31721# Oak Ridge National Lab., Tenn.
POSTIRRADIATION TENSILE BEHAVIOR OF NICKEL-DOPED FERRITIC STEELS
R. L. Klueh, P. J. Maziasz, and J. M. Vitek 1986 19 p Presented at the 2nd International Conference on Fusion Reactor Materials (ICFRM-2), Chicago, Ill., 13 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-009502; CONF-860421-25) Avail: NTIS HC A02/MF A01

Tensile specimens of normalized-and-tempered 9Cr-1MoVNb, 9Cr-1MoVNb-2Ni, 12Cr-1MoVW, 12Cr-1MoVW-1Ni, and 12Cr-1MoVW-2Ni were irradiated in the Experimental Breeder Reactor at 390, 450, 500, and 550(0)C to displacement-damage levels of approximately 16 dpa. The only difference in the effect of irradiation on the tensile behavior of the nickel-doped and undoped steels was attributed to the difference in tempering treatments the two types of steels received. The nickel-doped steels were stronger prior to irradiation due to a lower tempering temperature. After irradiation, the properties of the steels with and without nickel were similar, indicating that the presence of nickel did not affect the behavior of the steels during irradiation. Nickel was added to the steels to study the effect of helium on the properties of these steels. Helium can be formed in an alloy containing nickel by irradiating in a mixed-spectrum reactor. To help determine the effect of helium on properties, these steels are also being irradiated in fast reactors, where little helium is formed. The present fast-reactor results indicate that it is feasible to use the nickel-doped ferritic steels to study helium effects. DOE

N86-31722# Argonne National Lab., Ill.
EFFECT OF HEAT TREATMENT AND IMPURITY CONCENTRATION ON SOME MECHANICAL PROPERTIES V-15Cr-5Ti ALLOY
B. A. Loomis, B. J. Kestel, and D. R. Diercks Mar. 1986 15 p Presented at the 2nd International Conference on Fusion Reactor Materials (ICFRM-2), Chicago, Ill., 13 Apr. 1986
(Contract W-31-109-eng-38)
(DE86-010498; CONF-860421-36) Avail: NTIS HC A02/MF A01

The effects of heat treatment and O, N, C, Si, and S impurity level on the yield strength, ductility, and fracture mode for specimens from four different heats of the V-15Cr-5Ti alloy are presented. The heat treatments for the alloy consisted of annealing as-rolled material for one hour at either 950, 1050, 1125, or 1200C. The total oxygen, nitrogen, and carbon impurity concentration ranged from 400 to 1200 wppm. The Si concentration ranged from 300 to 1050 wppm, and the S concentration ranged from 440 to 1100 wppm. The yield strength and ductility for the alloy, regardless of impurity concentration, exhibited minimum and maximum values, respectively, for the 1125C anneal. The primary mode of failure for the tensile specimens was transgranular fracture. DOE

N86-31723# Argonne National Lab., Ill.
EFFECT OF HELIUM ON SWELLING AND MICROSTRUCTURAL EVOLUTION IN ION-IRRADIATED V-15Cr-5Ti ALLOY
B. A. Loomis, B. J. Kestel, S. B. Gerber, and G. Ayrault Mar. 1986 29 p Presented at the 2nd International Conference on Fusion Reactor Materials (ICFRM-2), Chicago, Ill., 13 Apr. 1986
(Contract W-31-109-eng-38)
(DE86-010510; CONF-860421-34) Avail: NTIS HC A03/MF A01

An investigation was made on the effects of implanted helium on the swelling and microstructural evolution that results from energetic single- and dual-ion irradiation of the V-15Cr-5Ti alloy. Single-ion irradiations were utilized for a simulated production of the irradiation damage that might be expected from neutron irradiation of the alloy in a reactor with a fast neutron energy spectrum (E > 0.1 MeV). Dual-ion irradiations were utilized for a simulated production of the simultaneous creation of helium atoms and irradiation damage in the alloy in the MFR environment. Experimental results are also presented on the radiation-induced segregation of the constituent atoms in the single- and dual-ion irradiated alloy. DOE

N86-31724# Argonne National Lab., Ill.
OVERVIEW OF TRANSPORT MECHANISMS IN BETA-LITHIUM/ALUMINUM
S. Susman, T. O. Brun, and K. J. Volin Mar. 1986 6 p Presented at the International Workshop on High Temperature Molten Salt Batteries, Argonne, Ill., 16 Apr. 1986
(Contract W-31-109-eng-38)
(DE86-010522; CONF-8604116-2) Avail: NTIS HC A02/MF A01

A systematic study over a period of years has resulted in identifying: (1) constitutional defects in -LiAl at room temperature, and (2) defects created at elevated temperatures. The relationshi

between these defects and charge and mass transport is discussed. The results bear upon the use of LiAl as the negative electrode both in room-temperature and solid state batteries and in high-temperature, molten-salt electrochemical cells. The key to unravelling the Li-conduction mechanism has been the recognition that there is a critical composition within the -phase domain corresponding to 50.7 at. % lithium. Free Li vacancies, bound Li vacancies, and reciprocal antisite defects contribute to the transport processes depending on temperature and composition. An understanding of these microscopic mechanisms has been used to remedy the loss of capacity with cycling of high temperature electrochemical cells. DOE

N86-31725# European Space Agency, Paris (France).
CORRELATION BETWEEN MICROSTRUCTURE AND FORGING CONDITIONS OF COMBINED DIE-FORGED (CDF) TI-6AI-4V POWDER
Wilfried Smarsly May 1986 154 p
(ESA-TT-952; DFVLR-FB-85-29; ESA-86-98076) Avail: NTIS HC A08/MF A01; German version available from DFVLR, Cologne, West Germany DM 47.50

Titanium-6Al-4V alloy powder in a steel can and a copper fluid die was compacted and forged and annealed at 950 C in an extrusion container by a hydraulic press and high velocity hammer using the combined die forging process to investigate its effects on the material porosity and morphology, on the powder alloy texture, and on the microstructure of the forged material. The results are required for development and optimization of a one-operation production procedure for components made of powder materials. The CDF process improves the fatigue properties and is adequate for the manufacturing of thick powder materials with optimal metallurgical microstructure and mechanical properties. Investigations of the ductility, strength and fatigue properties of the powder materials under the combined die forging conditions are recommended. ESA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-31726*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMINE TERMINATED BISASPARTIMIDE POLYMER Patent
Devendra Kumar, inventor (to NASA) (National Academy of Sciences - National Research Council, Washington, D. C.), George M. Fohlen, inventor (to NASA), and John A. Parker, inventor (to NASA) Issued 15 Jul. 1986 8 p Filed: May 31, 1985
(NASA-Case-ARC-11421-2; US-Patent-4,600,769; US-Patent-Appl-SN-739760; US-Patent-Class-528-322; US-Patent-Class-428-473.5; US-Patent-Class-528-170; US-Patent-Class-528-220; US-Patent-Class-528-321) Avail: US Patent and Trademark Office CSCL 11B

Novel amine terminated bisaspartimides are prepared by a Michael-type reaction of an aromatic bismalteimide and an aromatic diamine in an aprotic solvent. These bisaspartimides are thermally polymerized to yield tough, resinous polymers cross-lined through -NH- groups. Such polymers are useful in applications requiring materials with resistance to change at elevated temperatures, e.g., as lightweight laminates with graphite cloth, molding material prepregs, adhesives and insulating material. Author

N86-31727* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCESS FOR PREPARING HIGHLY OPTICALLY TRANSPARENT/COLORLESS AROMATIC POLYIMIDE FILM Patent
Anne K. St.Clair, inventor (to NASA) and Terry L. St.Clair, inventor (to NASA) Issued 29 Jul. 1986 9 p Filed 23 Aug. 1984 Supersedes N85-21360 (23 - 12, p 1811)
(NASA-Case-LAR-13351-1; US-Patent-4,603,061; US-Patent-Appl-SN-643589; US-Patent-Class-427-162; US-Patent-Class-264-212; US-Patent-Class-264-236; US-Patent-Class-427-164; US-Patent-Class-427-165; US-Patent-Class-428-336; US-Patent-Class-428-473.5) Avail: US Patent and Trademark Office CSCL 11B

An aromatic condensation polyimide film that is approximately 90% transparent at 500 nm, useful for thermal protective coatings and the process for preparing same are disclosed. A feature to achieve maximum optical transparency films requires the utilization of recrystallized and/or sublimated specific aromatic diamines and dianhydride monomers and the introduction of bulky electron withdrawing groups and separator groups into the polymer molecular structure. NASA

N86-31728*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CRYSTALLOGRAPHICAL AND GEOMETRICAL CHANGES OF A FERRITE HEAD ON MAGNETIC SIGNALS DURING THE SLIDING PROCESS WITH MAGNETIC TAPE
Kazuhisa Miyoshi, Donald H. Buckley, and Kyuichiro Tanaka (Kanazawa Univ., Japan) 1986 26 p Presented at the Joint Tribology Conference, Pittsburgh, Pa., 19-22 Oct. 1986; sponsored by ASLE and ASME
(NASA-TM-87277; E-2955; NAS 1.15:87277) Avail: NTIS HC A03/MF A01 CSCL 14E

This paper reviews changes in the crystalline structure and geometry of lapped Mn-Zn ferrite heads in sliding contact with magnetic tape and the effects of these changes on magnetic signals. A highly textured, polycrystalline structure was produced on the surface of a single-crystal Mn-Zn ferrite head when it was finished with an aluminum oxide lapping tape. Sliding this lapped surface against a magnetic tape produced a nearly amorphous structure. The sliding process led to a degradation in readback signal of 1 to 2 dB (short-wavelength recording). Furthermore, wear of the magnetic head caused geometrical changes in the head surface. The signal read back with the worn magnetic head was sensitive to operating parameters such as head displacement and tape tension. A change in operating parameters created head-to-tape spacings and, consequently, excessive gains or losses in the readback signal. Author

N86-31729*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF PROCESSING AND SINTERING VARIABLES WITH THE STRENGTH AND RADIOGRAPHY OF SILICON NITRIDE
William A. Sanders and George Y. Baaklini (Cleveland State Univ., Ohio) 1986 37 p Presented at the Tenth Annual Conference on Composites and Advanced Ceramic Materials, Cocoa Beach, Fla., 19-24 Jan. 1986; sponsored by the American Ceramic Society
(NASA-TM-87251; E-2934; NAS 1.15:87251) Avail: NTIS HC A03/MF A01 CSCL 11G

A sintered Si3N4-SiO2-Y2O3 composition, NASA 6Y, was developed that reached four-point flexural average strength/standard deviation values of 857/36, 544/33, and 462/59 MPa at room temperature, 1200 and 1370 C respectively. These strengths represented improvements of 56, 38, and 21 percent over baseline properties at the three test temperatures. At room temperature the standard deviation was reduced by over a factor of three. These accomplishments were realized by the iterative utilization of conventional x-radiography to characterize structural (density) uniformity as affected by systematic changes in powder processing and sintering parameters. Accompanying the improvement in mechanical properties was a change in the type of flaw causing failure from a pore to a large columnar beta- Si3N4 grain typically 40 to 80 microns long, 10 to 30 microns wide, and with an aspect ratio of 5:1. Author

N86-31730*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LUBRICATION HANDBOOK FOR THE SPACE INDUSTRY. PART A: SOLID LUBRICANTS. PART B: LIQUID LUBRICANTS

Ernest L. McMurtrey Dec. 1985 419 p
(NASA-TM-86556; NAS 1.15:86556) Avail: NTIS HC A18/MF A01 CSCL 11H

This handbook is intended to provide a ready reference for many of the solid and liquid lubricants used in the space industry. Lubricants and lubricant properties are arranged systematically so that designers, engineers, and maintenance personnel can conveniently locate data needed for their work. This handbook is divided into two major parts (A and B). Part A is a compilation of solid lubricant suppliers information on chemical and physical property of data of more than 250 solid lubricants, bonded solid lubricants, dispersions, and composites. Part B is a compilation of chemical and physical porperty data of more then 250 liquid lubricants, greases, oils, compounds, and fluids. The listed materials cover a broad spectrum from manufacturing and ground support to hardware applications of spacecraft. Author

N86-31731# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
HOVEL MACROMOLECULAR STRUCTURES AND COMPOSITES Final Report, 1 Aug. 1983 - 31 Jul. 1984
Frank E. Karasz Jun. 1985 12 p
(Grant AF-AFOSR-0341-83)
(AD-A166243; AFOSR-86-0143TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The Dynastat mechanical testing instrument purchased under the URIP Grant is now fully operational. It is presently being used to a large extent for research involving the Farris research group. The projects primarily influenced and which constitute about 90% of the time on the instrument are the AFML, Molecular Composites Program and a DOD LOVA program. The instrument is sufficiently versatile that it can be used for a multitude of materials and is especially useful for very stiff materials, a region where most instruments fail. As an example of the type of data that can be taken we have included some recent data. Illustrated is the in-phase modulus in uniaxial compression of a polyacetal-polyurethane thermoplastic elastomer as a function of frequency at several temperatures. Also shown is the master curve for this material using the computerized timer-temperature/frequency-temperature shifted data. Also included are reduced data at 40% and 60% filler content. Finally, the curing of a graphite-epoxy prepreg in shear during cure is shown. In this experiment the sample is being increased in temperature linearly with time. The prepreg softens at about 50 C and little happens until 160 C where reaction commences, as illustrated by a drop in the loss factor and an increase in the stiffness. It is currently being used to develop a new Impulse Method of Viscoelastic characterization which related time-integrals of stress to time integrals of strain for pulse. GRA

N86-31732# GTE Sylvania, Inc., Waltham, Mass.
ELECTRICAL AND ENVIRONMENTAL STUDIES OF CONDUCTION POLYMERS Final Report, 14 Sep. 1984 - 14 Oct. 1985
Mark A. Druy 17 Jan. 1986 63 p
(Contract N62269-84-C-0274)
(AD-A167737; NADC-86020-60) Avail: NTIS HC A04/MF A01 CSCL 11/9

The objective of this research was to present a clear and defined strategy toward the synthesis of environmentally stable conducting polymers, paying particular attention to the influence of the dopant on the electrical conductivity, environmental stability, and the dielectric properties. This involves a fundamental understanding of the molecular basis for the electrical properties and the interaction of the dopant with the polymer backbone. On the basis of an investigation into the kinetics of the degradation of electrical conductivity in two conducting polymer systems, it was identified which is thermally stable in an inert atmosphere and whose degradation of conductivity when exposed to air follows first order kinetics. Specific examples are polypyrrole/toluene sulfonate and multicomponent system comprising polypyrrole, toluene sulfonate, and a processible polymeric component. The capability to predict adequately the environment stability of a conducting polymer on the basis of a kinetic treatment of accelerated life tests was also demonstrated for the first time. Another conducting polymer system, namely multicomponent polythiophene/poly THF was found to be less stable with respect to polyprrole and it follows a multi-order degradation process in laboratory air. The dielectric properties of the above materials were investigated over the frequency rate from 1-100 GHZ. GRA

N86-31733# National Bureau of Standards, Gaithersburg, Md. Polymers Div.
EXPLORATION OF ADVANCED CHARACTERIZATION TECHNIQUES FOR MOLECULAR COMPOSITES Final Report, Feb. 1984 - Jan. 1985
D. L. VanderHart, F. W. Wang, R. K. Eby, B. M. Fanconi, and K. L. DeVries Feb. 1986 183 p
(Contract MIPR-FY1457-84-N-5019; AF Proj. ILI-R)
(AD-A168102; AFWAL-TR-85-4137) Avail: NTIS HC A09/MF A01 CSCL 07/4

The techniques of solid state nuclear magnetic resonance, fluorescence spectroscopy, electron spin resonance, and X-ray diffraction were applied to characterize aspects of the solid state structures of rigid rod polymers and their blends with flexible polymers. NMR and fluorescence spectroscopies were used to investigate the degree to which the rigid rod - flexible polymer blends exist as phase separated systems. It was found that these materials form primarily phase segregated structures, a condition which limits the reinforcing potential of rigid rod polymers in molecular composites. Most specimens exhibited NMR signals indicative of mobile, and presumably lower molecular weight, species. It is postulated that these mobile species are either water or residual acid from which the materials are processed. Information regarding the location of the mobile species in the structures exhibited by rigid rod polymers and their blends with flexible polymers is deduced from NMR. Electron spin resonance measurements confirmed that free radicals are generated while mechanically stressing rigid rod polymer fibers. The as-processed fibers contained appreciable levels of free radicals and annealing at elevated temperatures caused a decrease in the free radical concentration by a factor of three. X-ray diffraction experiments were conducted at elevated pressure in a diamond anvil cell. GRA

N86-31734# Oak Ridge National Lab., Tenn.
EVIDENCE FOR THE FORMATION OF A METASTABLE CRYSTALLINE PHASE DURING CRYSTALLIZATION OF Zr-Ni METALLIC GLASSES OF APPROXIMATELY 57 TO 63.2 AT. % Zr
C. G. McKamey, D. S. Easton, and D. M. Kroeger 1985 7 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-005031; CONF-851217-25) Avail: NTIS HC A02/MF A01

The crystallization of rapidly solidified Zr-Ni metallic glasses has been studied by differential scanning calorimetry (DSC), X-ray diffraction (XRD), and transmission electron microscopy (TEM). Evidence has been found for a metastable phase which is the first crystalline phase to form upon heating in compositions of 57 to 63.2 at. % Zr. This phase seems to be more easily formed and is most stable in the region of 58 to 59 at. % Zr. Upon subsequent heating to higher temperatures, the metastable phase transforms to the equilibrium phases ZrNi and Zr2Ni. The relationship of this new phase to phase separation at the eutectic composition of 63.5 at. % Zr is discussed in support of the conclusions drawn from low temperature specific heat studies reported previously. DOE

N86-31735# Oak Ridge National Lab., Tenn.
CHEMICAL VAPOR INFILTRATION OF FIBER-REINFORCED CERAMIC COMPOSITES
D. P. Stinton, A. J. Caputo, R. A. Lowden, and T. M. Besmann 1986 8 p Presented at the 2nd International Sympoisum on Ceramic Materials and Components for Engines, Luebeck-Travemuende, West Germany, 14 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-009513; CONF-860413-1) Avail: NTIS HC A02/MF A01

A process has been developed for the fabrication of fiber-

reinforced SiC composites by chemical vapor infiltration. Infiltration times for the low-density fibrous structures were reduced significantly from previous processes by simultaneously utilizing a thermal gradient and forced gas flow. Uniform matrix deposition occurred throughout unidirectional-fiber, cloth, or random chopped-fiber preforms to produce composites with densities approaching 90% of theoretical. Fabrication of composites in this fashion produced specimens with high flexural strengths and with a strain at maximum load which significantly exceeded those of conventional SiC bodies. DOE

N86-31736# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF S-GLASS CERAMIC LOT NO. 84-132 FOR USE AS A STANDARD REFERENCE MATERIAL
R. M. Merrill, J. P. McCarthy, and R. J. Antepenko Apr. 1986 43 p Prepared in cooperation with Mound Lab., Miamisburg, Ohio and General Electric Co., Largo, Fla.
(Contract DE-AC04-76DP-00789)
(DE86-010309; SAND-86-0065) Avail: NTIS HC A03/MF A01

Silicate glass properties such as thermal coefficient of expansion, and molten viscosity can be altered by changing the formulation. One glass, called S-glass ceramic, and hereafter denoted simply as S-glass, has been specifically designed to be crystallized to a glass ceramic with a coefficient of expansion that matches Inconel 718, and has a molten viscosity low enough to flow into tight configurations without the formation of voids or bubbles. Since the glass must meet rigorous chemical and mechanical specifications, samples from each batch or lot have been chemically analyzed. A major difficulty in these analyses has arisen from a lack of suitable standards. NBS has several silicate glasses certified as standard reference materials; however, none of them contains all of the constituents present in S-glass, and for some of the constituents no standard exists which has a certified value close to the levels present in S-glass. For these reasons, it was decided that one complete melt of S-glass would be extensively analyzed by several different laboratories and dedicated for use as a reference standard. The batch's melting history was closely monitored, and the starting materials were well characterized. DOE

N86-31737# Pennsylvania State Univ., University Park.
LASER PROCESSING OF CERAMICS Final Technical Report, 1 Jun. 1981 - 30 Nov. 1985
G. L. Messing, J. P. Pollinger, R. Geary, and R. Shelleman May 1986 10 p
(Contract DE-AC02-81ER-10949)
(DE86-011954; DOE/ER-10949/T2) Avail: NTIS HC A02/MF A01

Progress towards understanding the nature of laser-ceramic interactions and their utilization for ceramic processing has been made. Correlations between observations on laser scanned ceramic substrates have been made to the laser-metal interaction literature. Correlations with melt solidification of metals, although a considerably different material system, have proven fruitful and have led to more insights about the thermodynamic and mechanistic nature of ceramic melt solidification. The original purpose of this study was to exclusively use a CO laser for ceramic melting and specifically to prepare ceramic powders. Unfortunately, it has not been possible to satisfactorily investigate powder preparation per se. Therefore, the results reported are primarily concerned with investigations of laser-ceramic interactions which involve rapid solidification of surfaces at cooling rates of 10^5 to 10^8 K/s. Because of the continuing interest in powder synthesis a plasma vaporization of solutions technique was investigated. The vapor synthesis method was adapted because of its potential utility for a wide range of material compositions. DOE

N86-31738# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
MOLECULAR WEIGHT DISTRIBUTIONS OF DURHAM POLYACETYLENE PRECURSOR POLYMERS
Kevin Harper and Peter G. James 1985 4 p
(ESA-86-97254) Avail: NTIS HC A02/MF A01

A low temperature gel permeation chromatography system was developed and used to obtain the molecular weight distributions of Durham polyacetylene precursor polymers. A concurrent light-scattering experiment indicates that the true weight-average molecular weights of the Durham-type polymers are approximately twice the polystyrene-equivalent molecular weights. Durham precursor polymers are genuine high molecular weight polymers, producing initially cis polyacetylene with up to 7,500 double bonds. ESA

N86-31739# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
HIGH TEMPERATURE ADHESIVES [LES ADHESIVES HAUTES TEMPERATURES]
P. Hebrard 1986 14 p In FRENCH Presented at GAMNI Assemblage par Collage dans l'Ind., Senlis, France, 8-9 Oct. 1985
(SNIAS-861-422-118; ESA-86-97603) Avail: NTIS HC A02/MF A01

The analysis of four adhesive systems capable of operation over 200 C is presented. Differential thermal analysis, thermogravimetric tests and dynamic viscoelastic analysis were carried out. Samples of epoxy-phenolic, polyimidic, and bismaleicimide adhesives were studied. The optimum polymerization cycles deduced from the tests are described. All the four systems are superior to epoxy adhesives and may work up to near 400 C. Polyimides are the most promising. ESA

N86-31740# European Space Agency, Paris (France).
DIFFUSION OF WATER VAPOR IN CFRP. MEASUREMENT OF THE DIFFUSION COEFFICIENT UNDER INFLUENCE OF CONCENTRATION
Harald Twardy Sep. 1985 70 p Original language document was announced as N85-24018
(ESA-TT-911; DFVLR-FB-84-41; ESA-86-97568) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 23

The diffusion coefficient of water vapor in CFRP was measured as a function of moisture content for epoxy resins Code 69 and BSL 914, and their carbon fiber laminates. In sorption and desorption mode, tested materials show considerable variation of the diffusion coefficient with moisture content. Time-dependent influences, which cannot be separated, appear in this dependency. An example with a varying and an equivalent constant diffusion coefficient is calculated and demonstrates differences of calculated moisture profiles in a CFRP laminate. ESA

N86-31741# Societe Nationale Industrielle Aerospatiale, Paris (France).
DESIGN OF ADHESIVE BONDED STRUCTURES FOR SPACECRAFT [CALCUL DE LIAISONS COLLEES STRUCTURALES DANS LES VEHICULES SPATIAUX]
Maigret and Martin 1986 15 p In FRENCH; ENGLISH summary Presented at ADHECOM, Bordeaux, France, 15 Apr. 1986
(SNIAS-861-430-114; ESA-86-97608) Avail: NTIS HC A02/MF A01

Computation tools and test procedures for spaceborne bonded structures are discussed. Standardized breaking strength and shear strain tests are described. The computation programs are verified by comparison between the predicted values and the experimental results. The described methods are shown to be appropriate to predict and characterize the behavior of bonded structures for space environments. ESA

N86-31742# Construcciones Aeronauticas S.A., Madrid (Spain).
MEASUREMENT OF THE GLASS TRANSITION TEMPERATURE (Tg) OF THE Z-14.203 MATERIAL (PARASOL C-212) [MEDIDA DE TG EN EL MATERIAL Z-14.203 (PARASOL C-212)]
E. Garate 7 Apr. 1985 7 p In SPANISH
(I-111/85; ESA-86-97661) Avail: NTIS HC A02/MF A01

The loss of stiffness of parasols manufactured with an acrylic resin was studied. Thermal analysis and torsion pendulum tests were performed. The results show a transition lower than specified

(75 C).A change of material to polycarbonates or higher transition acrylates is recommended. ESA

N86-31743# Construcciones Aeronauticas S.A., Madrid (Spain).
CERTIFICATION OF THE ZIRSHOT Z-600 AND Z-150 CERAMIC SHOT [HOMOLOGACION DE LOS PERDIGONES CERAMICOS ZIRSHOT Z600 Y Z150]
L. E. Lopez 14 Apr. 1985 7 p In SPANISH
(I-112/85; ESA-86-97662) Avail: NTIS HC A02/MF A01

The chemical, crystallographic, physical, and dimensional characteristics of ceramic shot are given. Performance tests were carried out in dry and wet conditions using standard machines for surface treatment. The analysis of the results shows that surface abrasion is less than the abrasion obtained using steel shot at the same air pressure, due to the lower density of the zirconium ceramic shot. It is concluded that these ceramic shots are interesting for low intensity operations. ESA

N86-31744# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoffe und Bauweisen.
DETERMINATION OF THE FRACTURE TOUGHNESS OF CERAMIC MATERIALS ON BENDING SAMPLES WITH DIFFERENT NOTCH TYPES, AT ROOM TEMPERATURE AND HIGH TEMPERATURE Ph.D. Thesis - Karlsruhe Univ., West Germany
Guenther Himsolt Dec. 1985 255 p In GERMAN; ENGLISH summary
(DFVLR-FB-85-67; ISSN-0171-1342; ESA-86-97585) Avail: NTIS HC A12/MF A01; DFVLR, Cologne, West Germany DM 113.50

A method which permits the determination of the crack length using simple relations from the corresponding compliance of a bending specimen was developed. Investigations on hot-pressed silicon nitride reaction-bonded SN and HPSiC show that the microstructural parameters and their dependence on the testing temperature mainly control the fracture toughness. Specimens with a straight-through notch show a dependence on the notch radius, and chevron-notched specimens reveal deteriorated crack initiation which can lead to a failure of the method. Materials can show an increase in fracture toughness with increasing crack length. Fractographic investigations indicate that the test method must be adapted to specific materials problems. Because of the difficulties with both notch types, a modified chevron notch is suggested. ESA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-31745# Materials Research Labs., Ascot Vale (Australia).
A REVIEW OF METHODS TO DETERMINE THE IGNITABILITY OF PYROTECHNIC COMPOSITIONS
Leo V. DeYong Feb. 1986 24 p
(AD-A167429; MRL-R-989) Avail: NTIS HC A02/MF A01 CSCL 21/2

Ignition of pyrotechnic materials is a problem that has had relatively little attention over the years. However, many tests have been developed in an attempt to measure the ability of an energetic material to ignite from various sources. These tests range from the simple sensitivity/safety type tests (spark and impact sensitivity, ignition temperature, etc.) to the more complex techniques which measure the energy required for ignition (hot wire, laser, arc-image furnace, spark). These tests are examined in this report and comments on each of their advantages/disadvantages and their applicability to studying pyrotechnic ignition are made.
Author (GRA)

N86-31746# Materials Research Labs., Ascot Vale (Australia).
PREDICTION OF IGNITION TRANSFER RELIABILITY IN PYROTECHNIC SYSTEMS USING THE VARICOMP TECHNIQUE
Leo V. DeYong Feb. 1986 18 p
(AD-A167430; MRL-R-898) Avail: NTIS HC A02/MF A01 CSCL 21/2

The reliability of transfer of ignition between two elements in an explosive train is of paramount importance to proper functioning of a device. Prediction of this reliability is therefore necessary in designing ignition systems. To overcome testing prohibitively large numbers of samples, penalty testing was developed. The VARICOMP technique is one such penalty test developed for explosive trains. This report examines the theory of the VARICOMP technique and applies it to predicting ignition reliability in pyrotechnic trains. This study shows that a modified VARICOMP technique can be used in conjunction with small sample theory to predict the available stimulus from an igniter in a pyrotechnic system and the ignition reliability of the acceptor pyrotechnic. The use of the Bruceton calibration technique can provide adequate precision and makes elaborate and expensive calibration experiments unnecessary. However, for reliable predictions to be obtained, care must be taken to design the experiment to simulate the actual design hardware as closely as possible. GRA

N86-31747# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF VARIOUS METALLIC/POLYMER FUELS IN A TWO-DIMENSIONAL SOLID FUEL RAMJET M.S. Thesis
Charles K. Scott, III Mar. 1986 62 p
(AD-A167889) Avail: NTIS HC A04/MF A01 CSCL 21/5

An experimental investigation was conducted of highly metallized (approximately 70% by weight) solid fuels burned in a two-dimensional solid fuel ramjet (SFRJ). High speed motion pictures were taken of the combustion process through viewing windows located at two locations along the fuel slab length. Films revealed various ejection events ranging from small particle ejections to large flakes of burning and non-burning material leaving the surface. Nine different fuels were tested at air mass fluxes of 0.2 and 0.5 pounds mass per inch squared per second and pressures ranging from 35 to 200 psia. There was evidence that both minor binder ingredient changes (polymer and curative) and the inclusion of magnesium resulted in larger required inlet step heights to sustain combustion. Most of the metallized fuels did not burn well at pressures below approximately 40 psia. Low air mass fluxes generally resulted in larger metallic surface agglomerations, larger particles in the gas phase and more dominant shedding of surface layers. GRA

N86-31748# Allied Corp., Morristown, N.J. Corporate Technology.
ADVANCED HYDROGEN STORAGE: MODIFIED VANADIUM HYDRIDES Final Report
G. G. Libowitz Aug. 1985 33 p
(Contract DE-AC02-76CH-00016)
(DE86-009916; BNL-37866) Avail: NTIS HC A03/MF A01

Body centered solid solution alloys of general composition V-Ti-M (where M = Fe, Mn, Cr, Al) were investigated for use as hydrogen storage materials. Phase relations and thermodynamic properties of the V-Ti-M-H systems were determined. It was found that the enthalpies and entropies of hydride formation were significantly higher (absolute values) than those of most intermetallic compounds. Because of their thermodynamic properties it was concluded that these alloy hydrides are not particularly suitable for hydrogen storage, but that the thermodynamic properties are most favorable for their use as hydrogen compressors or in hydride heat pumps. DOE

N86-31749# Los Alamos National Lab., N. Mex.
EFFECTS OF PHYSICAL PROPERTIES ON THE INITIATION BEHAVIORS OF HETEROGENEOUS HIGH EXPLOSIVES
P. K. Tang, C. A. Forest, J. N. Johnson, and W. L. Seitz 1986 7 p Presented at the International Symposium on Intense Dynamic Loading and its Effects, Beijing, China, 3 Jun. 1986
(Contract W-7405-eng-36)
(DE86-000807; LA-UR-85-3375; CONF-860616-2) Avail: NTIS

HC A02/MF A01

Results are presented of an investigation into the shock initiation of high explosives with respect to the effects of density and grain sizes. The investigators used a model of treating high-explosive reaction with a multistep process which includes the hot-spot excitation, decomposition, and the propagation of reaction into the region outside the hot spots. The roles of various parameters are discussed; in particular, the hot-spot mass fraction, the reference hot-spot temperature, and the temperature sensitivity parameter are cited as the key factors in the observed behaviors. DOE

N86-31750# Los Alamos National Lab., N. Mex.
RADIAL BUILDUP TO DETONATION IN PENTAERYTHRITOL TETRANITRATE (PETN)
R. H. Dinegar Oct. 1985 9 p Presented at the International Symposium on Intense Dynamic Loading and its Effects, Beijing, China, 3 Jun. 1986
(Contract W-7405-eng-36)
(DE86-002383; LA-UR-85-3554; CONF-860616-6) Avail: NTIS HC A02/MF A01

Purified PETN was pressed to a density of 0.95 g/cc in Lucite cylinders of 2.54-cm diameter and 0.76-cm length. These charges were initiated by means of an exploding bridgewire located in the center of one face of the pressing. The firing capacitance and inductance were held constant. The energy delivered to the explosive charge was changed by varying the condenser voltage. The radial buildup to detonation was recorded by a rotating mirror camera with the slit perpendicular to the bridgewire. Results are discussed. The conclusion is that the deflagration to detonation development is not perfectly spherical from the initiation source but more ellipsoidal with the highest rate oriented along the charge length. DOE

N86-31751# Sandia National Labs., Albuquerque, N. Mex.
EFFECTS OF WELLBORE LIQUIDS IN PROPELLANT-BASED FRACTURING
J. F. Cuderman 1986 8 p Presented at the 27th US Symposium on Rock Mechanics, Tuscaloosa, Ala., 23 Jun. 1986
(Contract DE-AC04-76DP-00789)
(DE86-007832; SAND-85-2075C; CONF-860609-8) Avail: NTIS HC A02/MF A01

In situ experiments at the Department of Energy's Nevada Test Site (NTS) have extended the technology of propellant-based fracturing to include liquid-filled, uncased boreholes. Previous work had developed the technology for liquid-free, uncased wellbores. Test results show tha fracturing behavior is considerably more complex in liquid-filled boreholes than in the liquid-free case. Compared to liquid-free boreholes, liquid-filled boreholes have faster pressure risetimes and lower peak pressures, large hydraulic-type fractures propagating several meters beyond the end of the test zone, numerous oscillations in the pressure history, and variable types of fracturing within a single test region. Multiple fracturing is initiated in the wellbore of a fluid-filled borehole when the proper propellant mixture is used but, unlike fluid-free wellbores where up to eight fractures propagate, only one to three hydraulic- and/or shear-type fractures propagate. Hydrodynamic effects involving liquid compression during borehole pressurization appear to be responsible for the differing phenomena observed in fluid-filled boreholes. DOE

N86-31752# Sandia National Labs., Albuquerque, N. Mex.
OPTICAL STUDIES OF CHEMICAL ENERGY RELEASE DURING SHOCK INITIATION OF GRANULAR EXPLOSIVES
R. E. Setchell 1985 33 p Presented at the 10th International Colloquium on Dynamics of Explosions and Reactive Systems, Berkeley, Calif., 4 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE86-010469; SAND-85-0760C; CONF-850830-9) Avail: NTIS HC A03/MF A01

Achieving a predictive understanding of shock growth to detonation in granular explosives requires an accurate description of the temporal and spatial behavior or chemical energy release following shock compression. Direct experimental observations of the complex mechanisms involved are very difficult, and global reaction rates are typically inferred from pressure or particle velocity measurements. In the present study, visible emission from an explosive/window interface is examined using instrumentation that provides spectral, temporal, and spatial resolution. This instrumentation includes an image-converter streak camera to record histories of emission intensities dispersed by a 0.25 m specrometer, an image-converter framing camera to record multiple images of a highly magnified area of the explosive surface, and a channel intensifier tube to greatly enhance the sensitivity of either camera. Planar impact experiments were conducted on a compressed-gas gun facility using samples of the explosives hexanitrostilbene and PBX-904. The streak emission records show a distinct structure within the earliest observable emission. DOE

N86-31753# Lawrence Livermore National Lab., Calif.
STUDY ON THE RHEOLOGY OF RX-08-FK LLNL'S PASTE EXPLOSIVE
E. vonHoltz Apr. 1986 30 p
(Contract W-7405-eng-48)
(DE86-010781; UCID-20737) Avail: NTIS HC A03/MF A01

Understanding the rheological properties of paste explosives (PEX) is vital to utilizing this technology in any application. We recently completed testing our current paste candidate, RX-08-FK. This PEX exhibited non-Newtonian flow properties, and could be analyzed via use of power law curves. Neglecting yield stress, the PEX data followed power law behavior, with the exponents (n) being in the region of 0.3 to 0.6 (expected region was 0.35 to 0.65). This classifies the PEX as having strongly pseudoplastic behavior (decreasing apparent viscosity with increasing shear rate). Using information extracted from this data, we were able to conclude that pressure transfer of this material from one configuration to another is a highly feasible concept. We estimate that to transfer 60 lb of our PEX through 4 feet of 1 inch ID tubing at 50°F, we would need a driving pressure of only 500 psi to accomplish the extrusion in less than 20 seconds. DOE

N86-31754# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC VALVES AND MINIATURE DEVICES [VANNES PYROTECHNIQUES, PYROMECANISMES MINIATURES ET ECROUS PYROTECHNIQUES]
J. C. Slama 1986 6 p In FRENCH Presented at 2nd ESA Symposium European sur les Mecanismis Spatiaux, Schloss Merrsburg, West Germany, 9-11 Oct. 1985
(SNIAS-861-422-112; ESA-86-97599) Avail: NTIS HC A02/MF A01

Devices developed for ballistic missiles and the Ariane launcher are described, including a normally closed valve, a normally open valve, miniature hydraulic pistons, and pyrotechnical stage separation devices. Most of the devices are manufactured in titanium alloy and their mass is of the order of a few hundred grams. The performance tests and the specifications are detailed. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-31755# Department of the Air Force, Washington, D.C.
NON-CONTACT POLISHING Patent Application
Brian S. Ahern, inventor (to Air Force) Filed 15 Jan. 1986 10 p
(AD-D012210; US-Patent-Appl-SN-818944) Avail: NTIS HC A02/MF A01 CSCL 20/12

A non-contact polishing apparatus is used for polishing semiconductor planar substrates. The substrate is set back from any surface and is held by a chuck fixed within a collar. This substrate holder assembly is placed within an enclosed container that has a non-abrasive solution therein. The container is mounted

to a high speed nutating table that provides random motion to the holder assembly. This action provides isotropic polishing with no polishing created defects on the substrate surface. GRA

N86-31756# Department of the Air Force, Washington, D.C.
LASER INDUCED SELECTIVE ELECTROLESS PLATING Patent Application
Michael J. Halliwell, inventor (to Air Force) Filed 17 Jan. 1986 14 p
(AD-D012223; US-Patent-Appl-SN-819558) Avail: NTIS HC A02/MF A01 CSCL 13/8

It is an object of the present invention to provide a novel method for selective maskless electroless plating. In accordance with the present invention there is provided a method for selectively plating a metal onto a workpiece which comprises, in combination, the steps of applying a sensitizing solution to the workpiece, directing a laser beam onto the workpiece in the area which is not to be plated, and thereafter contacting the workpiece with an electroless plating solution to achieve plating thereon. GRA

N86-31757# Sandia National Labs., Albuquerque, N. Mex.
CONTROL OF PRECIOUS METAL PLATING BATHS USING ELECTROGRAVIMETRIC ANALYSIS
W. G. Yelton 1986 13 p Presented at the 10th International Conference on Precious Metals, Lake Tahoe, Nev., 8 Jun. 1986
(Contract DE-AC04-76DP-00789)
(DE86-005435; SAND-85-2550C; CONF-860677-1) Avail: NTIS HC A02/MF A01

This paper is an outline of an electrogravimetric method for inventory control of precious metal plating baths. The procedure is meant to be applicable to a plating shop environment to provide in-process control. A short review of procedural techniques for sample preparation and analysis are included. The paper deals with the basic how to approach for developing a practical system of analytical control of precious metal electroplating baths permitting accountability of 99% or greater. DOE

N86-31758# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Sciences.
SEMIMANUFACTURED PRODUCTS MADE OF COPPER AND COPPER ALLOYS: AN ANALYSIS OF PRODUCTION AND SALE IN A WORLD PERSPECTIVE [HALFFABRIKATEN VAN KOPER EN KOPERLEGERINGEN: EEN ANALYSE VAN PRODUKTIE EN AFZET IN MONDIAAL PERSPEKTIEF]
Ad Sannen 1984 69 p In DUTCH
(EUT/BDK/15; ISBN-90-6757-015-X; ESA-86-97687) Avail: NTIS HC A04/MF A01

Semimanufactured products based on copper or copper alloys were investigated with a view to an economical and technically justified production in copper-exporting developing countries. The structure of the world copper industry is presented. The recycling of copper for industrial applications is discussed. The market for semimanufactured products and the copper market in developing countries is presented. ESA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-31759 National Physical Lab., Teddington (England). Div. of Quantum Metrology.
AN INTRODUCTION TO THE OPTICAL HETERODYNE RECEIVER
R. H. Bradsell Feb. 1986 16 p
(NPL-QU-77; ISSN-0309-3050; ESA-86-97265) Copyright. Avail: Issuing Activity

A theoretical model for the direct optical video detector and the optical heterodyne mixer is developed. The advantages of the latter are enumerated and the performance of a typical system is analyzed. ESA

N86-31760*# Ford Aerospace and Communications Corp., Palo Alto, Calif. Western Development Labs. Div.
SPACECRAFT MULTIBEAM ANTENNA SYSTEM FOR 30/20 GHz Final Report
T. E. Roberts and W. F. Scott 10 Jan. 1984 70 p
(Contract NAS3-22498)
(NASA-CR-174654; NASA4-1-5-Z-F; NAS 1.26:174654; WDL-TR-10138) Avail: NTIS HC A04/MF A01 CSCL 17B

The major technical tasks that led to the definitions of operational and demonstration multiple beam antenna (MBA) flight systems and a proof of concept model (POC) are described. Features of the POC Model and its measured performance are presented in detail. Similar MBA's are proposed for transmitting and receiving with the POC Model representing the 20 GHz transmitting antenna. This POC MBA is a dual shaped-surface reflector system utilizing a movable free array to simulate complete CONUS coverage. The beam forming network utilizes ferrite components for switching from one beam to another. Measured results for components, subsystems and the complete MBA confirm the feasibility of the approach and also show excellent correlation with calculated values. Author

N86-31761# Technische Hogeschool, Delft (Netherlands). Vakgroep Microgolftechniek.
SIMULATION STUDY SYNTHETIC APERTURE RADAR IMAGERY (SIMSAR) [SIMULATIESTUDIE SAR-BEELDVORMING (SIMSAR)]
Apr. 1984 15 p In DUTCH
(ESA-86-97554) Avail: NTIS HC A02/MF A01

Investigations into the numerical simulation of a SAR system are presented. A quasi two-dimensional model for a collection of point objects was extended to three dimensions. Software for calculating the rough radar signal via the frequence domain was derived. Existing software was extended with the implementation of a SAR-processor. Multilook SAR was simulated and its transfer functions were determined. The power density spectrum (PDS) of the theoretical model was compared with the PDS of the simulated data and the real SAR-data. For individual titles, see N86-31762 through N86-31763.

N86-31762# Technische Hogeschool, Delft (Netherlands). Vakgroep Microgolftechniek.
SIMSAR STUDY, SECTION 1 Progress Report, Jun. 1983 - Dec. 1983 [SIMULATIESTUDIE SAR-BEELDVORMING (SIMSAR)]
In its Simulation Study Synthetic Aperture Radar Imagery (SIMSAR) Apr. 1984 3 p In DUTCH (For primary document see N86-31761 23-32)
Avail: NTIS HC A02/MF A01

Investigations into the numerical simulation of a SAR system are presented. Software for calculating the rough radar signal (RRS) via the frequency-domain, was derived. The RRS was calculated in a 1024 point-objects area (with mutual 10 wavelengths distance) in flight direction. Existing software was extended with the implementation of a SAR-processor, consisting of a matched filter from which the transfer-function is anew to be determined for each distance. Part of the Doppler-spectrum was selected by filtering. Speckle was reduced counting subspectra signals on power base. Transfer functions were determined using Gauss functions in the frequency and time-domain. The power density spectrum (PDS) of the theoretical model was compared with the PDS of the simulated data and the real SAR-data. ESA

N86-31763# Technische Hogeschool, Delft (Netherlands). Vakgroep Microgolftechniek.
SIMSAR STUDY, SECTION 2 Progress Report, Dec. 1982 - Jun. 1983 [SIMULATIESTUDIE SAR-BEELDVORMING (SIMSAR)]
In its Simulation Study Synthetic Aperture Radar Imagery (SIMSAR) Apr. 1984 4 p In DUTCH (For primary document see N86-31761

23-32)
Avail: NTIS HC A02/MF A01

Investigations into the numerical simulation of a SAR-system are presented. A quasi two-dimensional model for a Collection of Point Objects (CPO) was extended to three dimensions. Assuming an isotropic dispersion of reflecting electromagnetic waves, every point object is described by strength and random phase. The radar platform is introduced and an expression for the voltage received (i.e., echo of the CPO) was derived. Necessary software, i.e., (1) the mixing of the rough signal of a Gaussic pulse radar, (2) the implementation of the SAR-processor, and (3) the generation of images which can be elaborated, was briefly described. Matrix multiplication and time-frequency domain transformations were carried out on an array-processor. ESA

N86-31764# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SCATTERING FROM A PLANAR EQUIANGULAR SPIRAL ANTENNA M.S. Thesis
Stephen C. Moraites Dec. 1985 68 p
(AD-A167068; AFIT/GE/ENG/85D-27) Avail: NTIS HC A04/MF A01 CSCL 09/5

This thesis presents analytical and numerical techniques for analyzing the scattering from a planar equiangular spiral antenna loaded at its terminals. The scattering matrix for the loaded antenna is derived as a function of the antenna load impedance. This derivation is the result of an analytical study of the voltage/current relationship at the antenna terminals along with an application of a multiport analysis of the scattering problem. A numerical technique is also developed that utilizes at different wavelengths common elements of the generalized impedance matrix of the moment method solution. This technique provides for rapid computation of the scattering properties of the spiral antenna across a band of frequencies. Author (GRA)

N86-31765# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A KERNEL DECISION SUPPORT SYSTEM FOR CANADIAN MILITARY SATELLITE COMMUNICATIONS SYSTEM PLANNING M.S. Thesis
James R. Leitch Dec. 1985 148 p
(AD-A167122; AFIT/GSO/ENS/85D-11) Avail: NTIS HC A07/MF A01 CSCL 17/2

The kernel requirements for a DSS to plan technically feasible SATCOM systems is developed. The literature review focuses on understanding the decision process and a search for a suitable analytic tool for SATCOM system design. A model of the decision process is developed. The model is found to be a semi-structured task as the management control level. The process involves independent and interdependent decisions at all levels of management. The decision process contains elements of the rational, satisfying, organizational procedures, political and individual differences perspectives of decision making. Link analyses is developed as the analytic tool to support the decision process. The initial equation is developed and the effects of multiple users and multiple access are added. Link analysis provides a straight forward method of determining technical feasibility. A set of parameters for link analysis and the attendant equations are developed. The representations, operations, memory aids, and control mechanisms necessary to implement the kernel DSS are determined. Two linkages for future modules were identified: the Analytic Hierarchy Process as a module to determine the SATCOM user's evaluation criteria and a cost module. The research concludes that a DSS is well suited to the SATCOM planning process. GRA

N86-31766# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
FIELDS IN THE FOCAL REGION OF PARABOLOID AND OFFSET PARABOLOID REFLECTORS
R. H. Ott and R. B. Dybdal 31 Mar. 1986 91 p
(Contract F04701-85-C-0086)
(AD-A167419; TR-0086(6925-05)-4; SD-TR-86-16) Avail: NTIS HC A05/MF A01 CSCL 09/5

While much development has been accomplished for reflector antenna technology, a need still exists in evaluating the impacts of design parameters. One such area is included in the design tradeoffs associated with the beam-scanning performance of reflector designs. A surface current integration analysis is derived which is exact to the order of physical optics. This analysis is applied to both circular and offset reflectors for on-axis and off-axis illumination for parameters which span the cases for which both substantial and minimal degradation with beam scan occur. The output of the analysis is cast in the form of contour plots defining the field structure in the focal region of the reflector. The results of the analyses compare favorably with data previously obtained for specialized parameters. GRA

N86-31767# Rome Air Development Center, Griffiss AFB, N.Y.
ROME AIR DEVELOPMENT CENTER AIR FORCE TECHNICAL OBJECTIVE DOCUMENT FISCAL YEAR 1987
Dec. 1985 65 p
(AD-A167425; RADC-TR-85-282; RADC-TOD-85-11) Avail: NTIS HC A04/MF A01 CSCL 17/2

This TOD describes the RADC technical programs in support of the Air Force Command, Control, Communications, and Intelligence (C3I) mission. The technical objectives have been aligned with the VANGUARD mission areas of Command, Control, and Communications (C3), Reconnaissance and Intelligence, Strategic Systems (Defense) and Technology as a means of focusing the RADC support of VANGUARD. This document is prepared to provide industry and universities with the midterm technical objectives in these areas. GRA

N86-31768# Naval Ocean Systems Center, San Diego, Calif.
MICROCOMPUTER OPTIMIZATION OF FEED EXCITATION VOLTAGES TO OBTAIN DESIRED ANTENNA RADIATION PATTERNS Final Report
John W. Rockway, James C. Logan, and Peder M. Hansen Feb. 1986 25 p
(AD-A167560; NOSC/TD-866) Avail: NTIS HC A02/MF A01 CSCL 09/5

Recently a computer program, MININEC, has become available that can be used to calculate antenna characteristics, including the actual current distribution on the array elements. This program is generally available and can run on various microcomputers. A design procedure for broadcast array antennas has been developed which uses this computer program to calculate antenna characteristics for a specified array geometry. These results are then used by a separate routine that optimizes the excitation voltages, by gradient search, in order to achieve, as nearly as possible, a specified pattern. GRA

N86-31769# Applied Physics, Inc., Albuquerque, N. Mex.
RADAR CROSS-SECTION OF DAMPED CYLINDERS AND ANISOTROPIC CYLINDERS Technical Progress Report
Richard Holland 17 Mar. 1986 25 p
(Contract N00014-85-C-0852; ARPA Order 4946)
(AD-A167773) Avail: NTIS HC A02/MF A01 CSCL 17/9

This quarter, we have generalized the TDFD RCS code to handle materials characterized by: (1) Lossy, frequency-dependent dielectrics, (2) Magnetic loss and conductivity, (3) Anisotropy in the xy plane, and (4) Embedded resistive or reactive sheets. Our treatment of frequency dependence goes beyond what had been the state of the art in TDFD codes; the frequency dependence here may be anisotropic and may extend across a molecular resonance. The techniques for doing this are documented in the attached article, Time-domain treatment of Maxwell's equations in frequency dependent media. This article was written for the March conference in Monterey and represents work entirely inspired by the present contract. GRA

N86-31770# Lawrence Livermore National Lab., Calif.
WIDE SPECTRUM MICROWAVE PULSE MEASUREMENT
R. J. King Jan. 1986 21 p
(Contract W-7405-eng-48)
(DE86-006662; UCID-20647) Avail: NTIS HC A02/MF A01

Various techniques are postulated as diagnostics for wide band microwave pulses. The diagnostics include determinations of both the instantaneous amplitude and the frequency content of one-shot pulses. DOE

N86-31771# Lawrence Livermore National Lab., Calif.
PROPAGATION OF LONG, HIGH-POWER MICROWAVE PULSES THROUGH THE AIR
G. H. Khanaka and J. H. Yee Mar. 1986 11 p
(Contract W-7405-eng-48)
(DE86-009619; UCID-20616) Avail: NTIS HC A02/MF A01

The passage of long, high-power microwave pulses in the atmosphere was studied using a one-dimensional computer code. The objective of this study was to obtain a time history of the electron conductivity and peak density, as well as the peak plasma density. The results are summarized as follows: (1) the threshold level depends on pulse frequency and length; (2) electron avalanche occurs only when the pulse intensity exceeds the threshold level for air break-down, and this results in tail erosion; (3) for higher pulse intensities, it requires less time to initiate electron avalanche, which results in transmitting smaller portions of the pulse; (4) the general characteristics of the electron density, conductivity, and plasma frequency are quite similar for both cases; and (5) as the pulse amplitude rises, the electron conductivity and density and the plasma frequency also rise. DOE

N86-31772# Lawrence Livermore National Lab., Calif.
SIG: A GENERAL-PURPOSE SIGNAL PROCESSING PROGRAM
D. Lager and S. Azevedo Feb. 1986 6 p Presented at the Institute for Electrical and Electronics Engineers International Conference on Circuits and Systems, San Jose, Calif., 5 May 1986
(Contract W-7405-eng-48)
(DE86-009725; UCRL-94111; CONF-860589-2) Avail: NTIS HC A02/MF A01

SIG is a general-purpose signal processing, analysis, and display program. Its main purpose is to perform manipulations on time- and frequency-domain signals. It also accommodates other representations for data such as transfer function polynomials. Signal processing operations include digital filtering, auto/cross spectral density, transfer function/impulse response, convolution, Fourier transform, and inverse Fourier transform. Graphical operations provide display of signals and spectra, including plotting, cursor zoom, families of curves, and multiple viewport plots. SIG provides two user interfaces with a menu mode for occasional users and a command mode for more experienced users. Capability exits for multiple commands per line, command files with arguments, commenting lines, defining commands, automatic execution for each item in a repeat sequence, etc. SIG is presently available for VAX(VMS), VAX (BERKELEY 4.2 UNIX), SUN (BERKELEY 4.2 UNIX), DEC-20 (TOPS-20), LSI-11/23 (TSX), and DEC PRO 350 (TSX). DOE

N86-31773# Brookhaven National Lab., Upton, N. Y.
MICROWAVE UNDULATOR
K. Batchelor Mar. 1986 22 p
(Contract DE-AC02-76CH-00016)
(DE86-009910; BNL-37817) Avail: NTIS HC A02/MF A01

The theory of a microwave undulator utilizing a plane rectangular waveguide operating in the TE(sub 10n) mode and other higher order modes is presented. Based on this, a possible undulator configuration is analyzed, leading to the conclusion that the microwave undulator represents a viable option for undulator wavelength down to about 1 cm where peak voltage and available microwave power considerations limit effectiveness. DOE

N86-31774# Kansas Univ., Lawrence. Dept. of Electrical and Computer Engineering.
EVOLVING DIRECTIONS OF PC APPLICATIONS IN ELECTROMAGNETICS ANALYSIS AND DESIGN
E. K. Miller and F. J. Deadrick 25 Mar. 1986 7 p Presented at the Tactical Communication Conference, Fort Wayne, Ind., 22 Apr. 1986 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE86-009695; UCRL-94310; CONF-8604170-1) Avail: NTIS HC A02/MF A01

This paper serves as both an introduction to electromagnetic analysis and design software for the personal computer, and also as a short introduction to the evolution of computer technology which has made such analysis possible. Progress in microprocessor technology, memory devices, mass storage devices, and software are outlined. The increasing availability and capabilities of modeling software now provides in a micro- or personal computer environment some modeling procedures formerly limited to mini- or mainframe computers. These and other aspects of the present status and anticipated future directions of PC applications in electromagnetics are discussed in the paper. DOE

N86-31775# Illinois Univ., Urbana. Dept. of Electrical and Computer Engineering.
COMPARISON OF CLIFFORD AND GRASSMANN ALGEBRAS IN APPLICATIONS TO ELECTROMAGNETICS, REVISION 1
G. A. Deschamps and R. W. Ziolkowski Feb. 1986 17 p Presented at the Advanced Research Workshop: Clifford Algebras and Their Applications To Mathematical Physics, Canterbury, England, 15 Sep. 1985 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE86-009716; UCRL-92562-Rev-1; CONF-8509246-1-Rev-1) Avail: NTIS HC A02/MF A01

Grassmann and Clifford algebras are compared as to their applications to electromagnetics. The Grassmann algebra applies directly to (exterior) differential forms leading to Cartan's calculus. Forms of various degrees correspond most naturally to electromagnetic quantities and their relations are expressed by means of the exterior differential operator d. These relations are conveniently represented either in space or space-time by flow diagrams. They reveal the existence of potentials (Poincare's Lemma), the independence from coordinate systems, and the role of the metric. All of these properties are briefly reviewed. A calculus for functions having their values in a Clifford algebra can also be developed based on the Dirac operator D, whose square is a generalized Laplacian. Besides its role in Dirac's theory of the electron, this Clifford calculus can also be adapted to electromagnetics, although less directly than with Cartan's calculus. The point of departure is the role of a metric in a Clifford algebra. This can be remedied by introducing the Hodge star operator in the Grassmann algebra, an operation that is needed to express the property of matter usually represented by means of epsilon and (MU). DOE

N86-31776# Los Alamos National Lab., N. Mex.
NUMERICS FOR THE SIMULATION OF ELECTROMAGNETIC-FIELD PROPAGATION IN NONIONIZED AND PLASMA MEDIA
J. E. Borovsky Mar. 1986 19 p
(Contract W-7405-eng-36)
(DE86-009798; LA-10627-MS) Avail: NTIS HC A02/MF A01

The numerical techniques used to simulate the propagation of low-frequency electromagnetic disturbances in Ohmic media and in collisional and collisionless plasmas are discussed. The scheme is based upon a multimedia propagation equation that is derived from Maxwell's equations. DOE

N86-31777# Oak Ridge National Lab., Tenn.
STANDARD GENERALIZED MARKUP LANGUAGE: A TECHNIQUE FOR DOCUMENT INTERCHANGE
J. D. Mason 1985 6 p
(Contract DE-AC05-84OR-21400)
(DE86-011504; DOE/OR-21400/T265) Avail: NTIS HC A02/MF A01

Technical communicators find themselves increasingly in need of communicating text electronically. Efforts were directed to providing a standardized mechanism for doing generic coding. The Standard Generalized Markup Language (SGML) has been developed for document interchange. It is a Drift International Standard and should become a full standard in 1986. SGML

provides not only a basis for coding and interchange, but also a means for complete descriptions of documents to support other processes. DOE

N86-31778# Research Inst. of National Defence, Linkoeping (Sweden). Applied Electronics Dept.
SAPIENS MEMO 11. ELECTROMAGNETIC CHARACTERISTICS OF THE CONICAL TRANSMISSION-LINE EMP SIMULATOR SAPIENS
Sven Garmland Feb. 1986 53 p
(FOA-C-30415-A3; ISSN-0347-3708; ESA-86-97240) Avail: NTIS HC A04/MF A01; Research Inst. of National Defense, Stockholm, Sweden

A bounded wave electromagnetic pulse simulator was tested. Electric field measurements reveal deviations from an ideal curve shape. The largest deviation is traced to the termination of the simulator antenna. High-frequency components radiate through the termination and low-frequency ones are terminated by a resistive load. The space in between, where the wavelength is equal to the dimension of the termination, presents difficulties. Here, the inductance of the termination is crucial. By increasing the diameter of the wires connecting the resistors of the termination, the inductance may be reduced. It is shown how TEM-reflections from the termination can be diminished from 10% to 2% by replacing the wires with cylinders made of chicken-wire. The electric and the magnetic fields measured inside and outside the simulator confirm the good qualities of the simulator design regarding the antenna bandwidth, the field impedance, homogeneity, and polarization. ESA

N86-31779# Siemens A.G., Munich (West Germany). Informationstechnische Grundlagen.
AUTOMATIC SPEECH RECOGNITION FOR LARGE VOCABULARIES Final Report, Dec. 1984
Abdulmesih Aktas, Bernhard Kaemmerer, Wolfgang Kuepper, and Helmut Lagger Bonn, West Germany BMFT Dec. 1985 128 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-DV-85-003; ISSN-0170-9011; ESA-86-97434) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27

An isolated word recognition system for large vocabularies (1000 to 5000 words) with 98% recognition performance was developed. It was implemented on an array processor for real time requirements. The speech signal is described by short time autocorrelation functions. Short response times as well as high recognition accuracies are achieved by means of a hierarchical classification scheme. A fast preselection stage yields a small number of suitable word candidates to be considered for further classification. To that end a linear segmentation or a segmentation based on acoustic or phonetic cues was performed. High selectivity is obtained by using fine temporal resolution and nonlinear time alignment in the final classification step. By taking into account phonetically identical fragments of words, a distinction between highly confusable words can be made. Speaker adaptation for new system users is performed within a relatively short training phase. ESA

N86-31780# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabt. Raumfahrtprogramme.
FEASIBILITY STUDY FOR A SAR TEST MONITOR Final Report, Dec. 1983
Wolfgang Gieraths, Paul Stuerzenhofaecker, and Joachim Flacke Bonn, West Germany BMFT Dec. 1985 119 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-013; ISSN-0170-1339; ESA-86-97457) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

An SAR test configuration including test equipment, SAR sensor, and a graphical/digital test monitor was investigated to evaluate the signal quality regarding test costs and test duration. The various tests and interfaces and related accuracy values are reviewed. The combination of a computer and a visual display unit allows processing of the test instrument readings and calculation and display of statistical parameters and histograms. The test implementation costs for an SAR specific measuring facility are twice as high as those for a layout with commercially available laboratory measuring instruments. ESA

N86-31781# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
TIME SYNCHRONIZATION VIA SYMPHONIE HIGH ACCURACY LOW COST (HALO) Final Report, Nov. 1983
Hans-Martin Sylwasschy Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1985 71 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-021; ISSN-0170-1339; ESA-86-97465) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15

The High Accuracy-Low cost (HALO) sidetone method, a modulation emitter, and a demodulation receiver were developed to meet accuracy and narrow band width requirements. The functional principle of HALO is described. Field measurements were performed with one modem and time comparative measurements with the two HALO modems. Compact arrangement, simple control of the station periods, and optimization of time signals regarding emission efficiency and band width are required. The HALO is an interface between comparative normal and link signals and produces an HF transfer signal from the comparative normal signals. The accuracy of 1 ns for time synchronization can be improved. The components developed for HALO can be applied to phase-sensitive systems. ESA

N86-31782# Technische Hogeschool Twente, Enschede (Netherlands). Afdeling der Technische Natuurkunde.
TRAVELING WAVES IN A ONE-DIMENSIONAL CHAIN WITH NONHARMONIC RECIPROCITY [LOPENDE GOLVEN IN EEN-DIMENSIONALE KETEN MET NIET-HARMONISCHE WISSELWERKING]
J. H. Wortel Jun. 1984 114 p In DUTCH
(ESA-86-97379) Avail: NTIS HC A06/MF A01

Traveling waves in a one-dimensional Lennard-Jones chain were studied by resolving a variance problem numerically. By integrating the motion equation numerically, the apporach was improved using the Poincare surface of section. Deviations were interpreted with the Floquet theory. Calculations were carried out for 3 and 12 particles. Up to a certain energy the waves are linearly stable; above this level they are linearly unstable (for three particles). ESA

N86-31783# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATIONS OF PULSE-PULSE INTERFERENCE IN HETERODYNE DETECTION
Friedrich Malota Dec. 1985 22 p Original language document was announced as N86-10544
(ESA-TT-949; DFVLR-FB-85-26; ESA-86-97582) Avail: NTIS HC A02/MF A01; original German version available from DFVLR, Cologne, West Germany DM 10

The interference of two laser pulses originating from the same source and thus having a constant frequency difference was investigated. The calculation of the heterodyne currents in the interference of two pulses is described. It is shown that a coherent pulse-pulse interference is possible in a pulse heterodyne system. Experimental data are in good agreement with theoretical predictions, especially the determination of the intermediate frequency. ESA

N86-31784# Technische Hogeschool, Delft (Netherlands). Vakgroep Microgoftechniek.
ANALYSIS OF A COMBINED FMCW PULSE RADAR SYSTEM FOR SIDE LOOKING AIRBORNE RADAR (SLAR) APPLICATIONS [ANALYSE VAN EEN GECOMBINEERD FMCW-PULS RADAR SYSTEEM VOOR SLAR TOEPASSINGEN]
Roger Timmerman Jan. 1985 79 p In DUTCH; ENGLISH summary
(Rept-05-1-533-A106-85; ESA-86-97707) Avail: NTIS

HC A05/MF A01

A theoretical and practical feasibility study for the development of an FMCW radar, combining features of FMCW and pulse radars was performed for application as SLAR for Earth observation. Design approaches were compared. Simulations with a network analyzer and an intermediate frequency system are presented. The simulation results are similar to a FMCW processed radar signal. A method to simulate the radar system at microwave frequencies is discussed. A block diagram of the final system is given. Noise behavior and transmitter power are discussed. ESA

N86-31785# Ecole Nationale Superieure des Telecommunications, Paris (France).

ADAPTIVE CONTROL OF THE ALOHA PROTOCOL IN A MOBILE RADIO CELLULAR SYSTEM Ph.D. Thesis [CONTROLE ADAPTATIF DU PROTOCOLE ALOHA DANS UN SYSTEME RADIOMOBILE CELLULAIRE]

Rasoamihamina RazananoelyRejo Jul. 1985 105 p In FRENCH (ENST-85E013; ISSN-0751-1353; ESA-86-97634) Avail: NTIS HC A06/MF A01

Simple retransmission strategies are adopted to allow for the utilization of the ALOHA synchronous random access protocol. Numerical simulations were performed using a model representing the set of mobiles and the base station of a cell. The main propagation problems are progressively incorporated in the simulation, showing that the adaptive policy is always the best. Controlled ALOHA and a traditional protocol such as AMRT are compared, defining for each case the limiting rate below which the proposed system is preferable. ESA

N86-31786# Societe Nationale Industrielle Aerospatiale, Cannes (France). Dept. of Electrical Engineering.

OPTICAL FIBER TRANSMISSION ON SATELLITES AND ORBITAL STATIONS

C. Lopez and J. M. Nakache 1986 7 p (SNIAS-861-440-106; ESA-86-97616) Avail: NTIS HC A02/MF A01

The possibilities and advantages offered by optical fiber transmission are explored. The analysis includes performance requirements, candidate link solutions, and laboratory implementation. The results of experiments carried out in laboratory are given, including behavior under radiated electromagnetic disturbances, comparison of detection device efficiencies, transmission of CCD video signals, and high rate digital transmission by optical slip ring. The laboratory experiments show compatibility of achieved performances with future needs. ESA

N86-31787# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

VULNERABILITY OF LOW REDUNDANCY IMAGE DATA AND TEXT TRANSMISSION OVER SATELLITE COMMUNICATION LINKS Final Report

H. J. Simons Paris ESA 10 Jul. 1985 76 p (Contract ESTEC-6235/85-NL-JS) (NLR-TR-85100-L; ESA-CR(P)-2185; ESA-86-97785) Avail: NTIS HC A05/MF A01

The effect of transmission errors on satellite communication links on uncompressed and compressed Earth observation image data and on compressed facsimile data are described. The error statistics on the ECS/SMS channel are studied. Because of the high level data link control transmission protocol, several types of errors are introduced. The effects of these errors on user data are evaluated qualitatively and quantitatively. ESA

N86-31788# Fondazione Ugo Bordoni, Rome (Italy).

LONGTERM SPEECH SPECTRA OF NONSTATIONARY AUTOREGRESSIVE MODELS

Giuseppe Martinelli, Gianni Orlandi, and Lucio PrinaRicotti Jun. 1985 7 p (FUB-8-1985; ESA-86-97884) Avail: NTIS HC A02/MF A01

Long term time-frequency spectra of words were obtained using autoregressive methods to characterize complete words without segmentation. The resulting spectra and the time dependent coefficients of the AR filter are compared with the short term stationary case. Examples show a better accuracy given by discussed method, in spite of the reduced number of parameters involved in the proposed representation. ESA

N86-31789# Fondazione Ugc Bordoni, Rome (Italy).

PHYSICAL SIGNIFICANCE OF LEAST MEAN SQUARES CRITERION IN NONSTATIONARY LATTICE PREDICTORS

Giuseppe Martinelli, Gianni Orlandi, Lucio PrinaRicotti, and Susanna Ragazzini Jun. 1985 10 p (FUB-9-1985; ESA-86-97885) Avail: NTIS HC A02/MF A01

An acoustical nonstationary model of the vocal tract is discussed. The effectiveness of the nonstationary lattice predictor in recovering the model is illustrated. The reflection coefficients are linearly decomposed on a function basis and the weights of the linear combinations are the new parameters of the model. Parameters are determined by an algorithm similar to Burg's by minimizing the sum of the variances of the forward and backward residuals. Synthetic signals of good approximation are obtained in two examples. ESA

N86-31790# Fondazione Ugo Bordoni, Rome (Italy).

INTERCONNECTION BETWEEN PACKET SWITCHING NATIONAL NETWORKS AND LOCAL PACKET RADIO COMMUNICATION NETWORKS [INTERFUNZIONAMENTO RETE NAZIONALE A COMMUTAZIONE DI PACCHETTO E RETI DI RADIOCOMUNICAZIONE A PACCHETTO]

Paolo Talone and Sebastiano Trigila Jul. 1985 17 p In ITALIAN Presented at 33rd Congresso Internazionale delle Comunicazioni, Genoa, Italy, Oct. 1985 (FUB-24-1985; ESA-86-97887) Avail: NTIS HC A02/MF A01

Multipoint topology networks based on a single statistically distributed radiocommunication channel are considered, referring only to restricted area networks with line of sight type links. The architecture and protocols of such networks are reviewed. The problems related to the interconnection of such networks with large public packet switching communication networks are examined. Several hypothesis are studied concluding that mainly in the case of emergencies or catastrophic events these networks are an extremely useful resource. ESA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-31791 Portsmouth Polytechnic (England). Dept. of Electrical and Electronic Engineering.

THE EFFECT OF PIGTAILING BRAIDED SCREENS ON THE TRANSFER IMPEDANCE OF SINGLE-ENDED AND BALANCED INTERFACE CIRCUITS

J. W. E. Jones, C. J. Lines, and J. S. Jahns Jan. 1985 17 p (EMCR-5/85; BR97103; ESA-86-97259) Avail: issuing Activity

The effects of short pigtails on the transfer impedance of 1 m lengths of screened cables were measured. Comparisons with a simple theory of the effect of pigtails show reasonable agreement. Measurements on twin cables are included. Results show that pigtails reduce shielding effectiveness at higher frequencies. The frequency at which this deterioration sets in is a function of cable length, cable transfer impedance, and pigtail length and spacing. ESA

N86-31792*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SENSOR FAILURE SIMULATOR FOR CONTROL SYSTEM RELIABILITY STUDIES

Kevin J. Melcher, John C. Delaat, Walter C. Merrill, Lawrence G.

Oberle, Gerald G. Sadler, and Joseph H. Schaefer 1986 43 p (NASA-TM-87271; E-3137; NAS 1.15:87271) Avail: NTIS HC A03/MF A01 CSCL 09A

A real-time Sensor Failure Simulator (SFS) was designed and assembled for the Advanced Detection, Isolation, and Accommodation (ADIA) program. Various designs were considered. The design chosen features an IBM-PC/XT. The PC is used to drive analog circuitry for simulating sensor failures in real-time. A user defined scenario describes the failure simulation for each of the five incoming sensor signals. Capabilities exist for editing, saving, and retrieving the failure scenarios. The SFS has been tested closed-loop with the Controls Interface and Monitoring (CIM) unit, the ADIA control, and a real-time F100 hybrid simulation. From a productivity viewpoint, the menu driven user interface has proven to be efficient and easy to use. From a real-time viewpoint, the software controlling the simulation loop executes at greater than 100 cycles/sec. Author

N86-31793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPACE SOLAR CELL RESEARCH: PROBLEMS AND POTENTIAL

Dennis J. Flood 1986 13 p Presented at the Conference on Photovoltaics for Commercial Solar Power, Cambridge, Mass., 15-19 Sep. 1986; sponsored by the Society of Photo-Optical Instrumentation Engineers

(NASA-TM-88833; E-3212; NAS 1.15:88833) Avail: NTIS HC A02/MF A01 CSCL 10A

The value of a passive, maintenance-free, renewable energy source was apparent in the early days of the space program, and the silicon solar cell was pressed into service. Efficiencies of those early space solar arrays were low, and lifetimes shorter than hoped for, but within a decade significant advances had been made in both areas. Better performance was achieved through improvements in silicon single crystal material, better device designs, and a better understanding of the factors that affect the performance of a solar cell in space. Chief among the latter, particularly for the mid-to-high altitude (HEO) and geosynchronous (GEO) orbits, are the effects of the naturally occurring particulate radiation environment. Although not as broadly important to the photovoltaic community at large as increased efficiency, the topic of radiation damage is critically important to use of solar cells in space, and is a major component of the NASA research program in space photovoltaics. A brief overview of some of the opportunities and challenges for space photovoltaic applications is given, and some of the current research directed at achieving high efficiency and controlling radiation damage in space solar cells is discussed. Author

N86-31794# Department of the Army, Washington, D. C.

SELECTIVELY ETCHING MICROSTRUCTURES IN A GLOW DISCHARGE PLASMA Patent Application

Edward J. Staples, inventor (to Army) Filed 17 Mar. 1986 12 p (AD-D012206; US-Patent-Appl-SN-845671) Avail: NTIS HC A02/MF A01 CSCL 13/8

Selective etching of microelectronic devices comprising crystal substrates is achieved by electrically masking conductive areas thereon which are not to be etched by ionic bombardment. The electrical masking is accomplished by biasing the selected areas with a bias voltage which will repel the ions, which are attracted to all of the unbiased portions of the microelectronic device. GRA

N86-31795# Department of the Navy, Washington, D. C.

APPARATUS AND METHOD FOR ALIGNING A MASK AND WAFER IN THE FABRICATION OF INTEGRATED CIRCUITS Patent

John F. Bass, Nelson Saks, and Martin Peckerar, inventors (to Navy) Issued 4 Feb. 1986 8 p Supersedes AD-D010595 (AD-D012208; US-Patent-Appl-SN-536125; US-Patent-Class-356-401) Avail: US Patent and Trademark Office CSCL 20/12

An apparatus and method for aligning a mask and wafer in the fabrication of integrated circuits utilizing alignment patterns on the mask and wafer is discussed. Each alignment pattern comprises a plurality of parallel alignment marks which are spaced from one another such that the patterns may be superimposed so that the marks of one pattern are positioned between marks of the other pattern. When the patterns are misaligned, a moire pattern is produced which disappears on alignment. The marks of each pattern are also disparately spaced from one another, permitting a gross to fine alignment. In aligning the patterns, each mark of one pattern is positioned between pairs of marks of the other pattern in an order corresponding to the widths of spaces defined between marks of the other pattern, progressing from the largest space width, giving gross alignment, to the smallest, giving fine alignment. Author (GRA)

N86-31796# Department of the Air Force, Washington, D.C.

HIGH POWER HIGH VOLTAGE LINEAR AMPLIFIER APPARATUS Patent

Walter E. Milberger, inventor (to Air Force) Issued 11 Feb. 1986 7 p Supersedes AD-D011028 (AD-D012244; US-Patent-4,570,129; US-Patent-Appl-SN-586955; US-Patent-Class-330-277) Avail: US Patent and Trademark Office CSCL 09/5

A high power, high voltage linear field effect transistor amplifier apparatus utilizing an automatic gate biasing network to normalize the gate threshold voltages of a plurality of field effect transistors which are in either series of parallel is discussed. Thus, these series or parallel combinations of field effect transistors may be operated as linear devices. A high-voltage, high power, wide-band carrier controlled linear amplifier is provided by utilizing an oscillator as a driver. Author (GRA)

N86-31797# Department of the Air Force, Washington, D.C.

MULTILAYER CERAMIC CAPACITOR ON PRINTED CIRCUIT Patent

Robert D. Larowe, inventor (to Air Force) Issued 4 Feb. 1986 6 p Supersedes AD-D011166 (AD-D012246; US-Patent-4,568,999; US-Patent-Appl-SN-617666; US-Patent-Class-361-306) Avail: US Patent and Trademark Office CSCL 09/1

The multilayer capacitor has the plates arranged vertically, which allows planar attachment with conductive epoxy to a substrate such as a thick film conductor on alumina. The top termination may use wire bonding. The capacitor has the same form factor and size as prior capacitors of the same electrical ratings. Author (GRA)

N86-31798# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

FOURIER TRANSFORM INFRARED SPECTROSCOPIC STUDY OF AGING IN COMMERCIAL POLYURETHANE

Robert S. Bretzlaff, Sherrie L. Zacharius, Stephen L. Sandlin, and Gail A. Cagle 28 Apr. 1986 22 p (Contract F04701-85-C-0086) (AD-A167418; TR-0086(6925-08)-3; SD-TR-86-22) Avail: NTIS HC A02/MF A01 CSCL 09/1

Satellite electronics systems may function for years before failing as a result of a shorted-out component. If the insulation is considered to be perfectly inert, then such failures would be inexplicable in terms of events intrinsic to the material. However, many physical and chemical changes may occur in the dielectric prior to breakdown. Hence, a polymer dielectric is not inert and may be more accurately thought of as a seething molecular and electronic cauldron, which gradually drifts in the direction of diminished resistance to applied electrical stress. After a time, which appears indefinite only because we have not adequately characterized the system, the constant electrical stress shorts out the degraded insulation. A correlation between decreases in infrared absorbance, molecular motion, electronic energy transfer, and increasing susceptibility to electric stress is supported by the data presented here. It is suggested that the development of new, voltage-stabilized materials can be greatly facilitated by using Fourier transform infrared spectroscopy (FTIR) as a diagnostic tool, and thermal aging as an accelerated aging test. GRA

N86-31799# Maryland Univ., College Park. Lab. for Plasma and Fusion Energy Studies.
DESIGN AND COLD TESTING OF A HIGH PEAK POWER X-BAND GYROKLYSTRON
W. Lawson, J. Calame, V. L. Granatstein, P. E. Latham, J. McAdoo, G. S. Park, C. D. Striffler, F. J. Williams, K. R. Chu, and J. L. Seftor 1985 3 p Presented at the International Conference on Infrared and Millimeter Waves, Lake Buena Vista, Fla., 8 Dec. 1985 Prepared in cooperation with Science Applications International Corp., McLean, Va.
(Contract DE-AC05-85ER-40216)
(DE86-006898; CONF-851238-5) Avail: NTIS HC A02/MF A01

The main goal of the University of Maryland's gyroklystron project is to develop an efficient, high power, high gain, phase controllable amplifier at 10 GHz. While peak powers of several hundred megawatts are ultimately of interest, our initial experimental design values include 30 MW of output power in 1 microsec pulses with a gain in excess of 50 dB. The 30 MW power level represents an enhancement of almost three orders of magnitude over the current state-of-the-art in gyroklystron amplifiers. This enhancement will be achieved by going to high beam energies (gamma approx. =2) and overmoded cavities (TE sup o sub 01). Outlined in this report are the steps being taken to realize this goal. DOE

N86-31800# Sandia National Labs., Albuquerque, N. Mex.
ACCESSIBILITY OF APPLICATIONS SPECIFIC INTEGRATED CIRCUITS
D. R. Strip Mar. 1986 16 p
(Contract DE-AC04-76DP-00789)
(DE86-009561; SAND-86-0514) Avail: NTIS HC A02/MF A01

Applications specific integrated circuits (ASICs) open new design opportunities in Sandia component applications. ASICs can be used to overcome many of the constraints that reduce system functionality in Sandia systems. Key constraints in our environment are power consumption, volume, weight, speed, and radiation-hardness. In addition, use of ASICs may reduce the costs of system design, acquisition, and life-cycle maintenance. Design tools for integrated circuits are rapidly simplifying the design of integrated circuits. Just as high level computer languages enabled applications-oriented computer users to take control of their own code development after assembly coding had limited the practicality of user design, in ICC design tools and approaches are enabling the applications-oriented user to design an ASIC with modest training and in a short time period. In order to demonstrate the state of the design systems, we have selected a representative application and, without any formal training or experience in IC design, have designed and fabricated an ASIC. This report details the steps that were followed and the time they took. It is important to emphasize that this project was the first chip designed start-to-finish on the Mentor design stations in Organization 2110; therefore most of the problems encountered were typical of a first pass through a new system. Most of the problems were quickly wrung out by the CAD tools staff; future users of the system should not expect to have the problems recur. DOE

N86-31801# Allied Bendix Corp., Kansas City, Mo.
EVALUATION OF HIGH TEMPERATURE ACCELERATED AGING TESTS USED ON INTEGRATED CIRCUITS Final Report
J. P. Gracey Apr. 1986 35 p
(Contract DE-AC04-76DP-00613)
(DE86-009615; BDX-613-3419) Avail: NTIS HC A03/MF A01

Accelerated aging tests such as high temperature burn-in, which are in current use on Bendix Kansas City Division's (BKC) purchased small and medium scale integrated circuits, were evaluated to determine if they are effective and necessary to ensure the required reliability. A theoretical analysis, a literature search, and a study of lot acceptance results were used to assess the value of integrated circuit burn-in. DOE

N86-31802# Oak Ridge National Lab., Tenn.
LIGHT EMISSION FROM METAL-INSULATOR-METAL STRUCTURES BIASED NEAR BREAKDOWN VOLTAGES
M. J. Bloemer, J. P. Goudonnet, D. R. James, R. J. Warmack, T. L. Ferrell, E. T. Arakawa, and T. A. Callcott 1986 4 p Presented at the International Symposium on Electrical Insulation, Washington, D.C., 8 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008505; CONF-860693-1) Avail: NTIS HC A02/MF A01

Optical emission is observed at prebreakdown voltages in thin film metal-insulator-metal (MIM) structures. Subsequent examination of the junction in a scanning electron microscope (SEM) reveals filamentary growth through the insulator. These tunnel junctions consist of Al-Al2O3-Ag or Al-Al2O3-Au with a variety of microstructures incorporated in the junction. The emission spectrum is found to be dependent on the geometry of the MIM structure. Comparison of theory and experiment suggests the emission results from the radiative decay of collective electronic excitations (surface plasmons) initiated by electrons tunneling through the insulator. DOE

N86-31803# California Univ., Berkeley. Lawrence Berkeley Lab.
SOLID ELECTROLYTE FOR HIGH ENERGY DENSITY BATTERIES
L. C. DeJonghe Dec. 1985 13 p Presented at the Japan Ceramic Society Meeting, Sendai, Japan, 24 Jan. 1986
(Contract DE-AC03-76SF-00098)
(DE86-009358; LBL-20816; CONF-860172-1) Avail: NTIS HC A02/MF A01

High energy density batteries, consisting of sodium/sodium polysulfide electrochemical couples, separated by the ion conducting ceramic electrolyte sodium beta- alumina, are now at the stage where commercialization is realistic. The detailed study of the various degradation processes occurring in the solid electrolytes have been shown to be avoidable by microstructural control of the electrolytes, limiting the grain size to below 50 micron everywhere by controlling the contamination levels of the system during operation, and by proper cell design that avoids current heterogeneity. DOE

N86-31804# Missouri Univ., Rolla.
CHARACTERIZATION OF THE REDOX BEHAVIOR AND STABILITY OF CONDUCTING OXIDES
H. U. Anderson, S. A. Howard, and D. M. Sparlin Jan. 1986 164 p
(Contract DE-FG02-85ER-45219)
(DE86-009871; DOE/ER-45219/T1) Avail: NTIS HC A08/MF A01

The goal of this study was to examine the relation between electrical conductivity, oxidation-reduction kinetics, defect structure, and composition of n- and p-type binary and ternary transition metal oxides. The experimental part included, thermogravimetry, X-ray diffraction, thermally stimulated current, oxygen diffusion, optical absorption, transmission electron microscopy, electrical conductivity, and Seebeck measurements. The oxide systems studied were La-doped SrTiO3, Mg-doped LaCrO3, Mg-doped LaMnO3, Sr-doped LaMnO3, and Nb-doped LaCrO3. Results show that at low oxygen activity donor doped LaCrO3 is n-type but becomes p-type as oxidation occurs; substitution of 50% Mn into LaCrO3 enables the compound to be sintered to high density in air at 1500 C; LaMnO3 tends to decompose as reduction occurs with Mg-doped LaMnO3 being more stable than Sr-doped LaMnO3; LaMnO3 decreases its conductivity at oxygen activities 10 to the third power to 10 to the fifth power times higher than for LaCrO3; and upon reduction Mg and Sr-doped LaCrO3 expands about 0.04% and 0.4% respectively. DOE

N86-31805# Northwestern Univ., Evanston, Ill.
INTERFACIAL ELECTROCHEMICAL TRANSPORT IN BATTERIES EMPLOYING SOLID ELECTROLYTES Annual Report
M. A. Ratner and D. F. Shriver 1986 14 p
(Contract DE-FG02-85ER-45220)
(DE86-010107; DOE/ER-45220/T1) Avail: NTIS HC A02/MF A01

This research project involves a multi-disciplinary investigation of ionic transport along and through interfaces, both within a solid electrolyte and at the electrode/electrolyte contact. The aim is to

gain mechanistic understanding of the processes which produce over-potentials and limit mobility at these interfaces, and thereby to suggest design steps for improved-performance of solid-state batteries. DOE

N86-31806# Technische Univ., Aachen (West Germany). Inst. fuer Theoretische Elektrotechnik.
ELECTRON-BEAM PROGRAMMABLE CONFIGURATION CIRCUITS Final Report, Sep. 1984
Reinhard Brock and Ulrich Theus Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 55 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-163; ISSN-0340-7608; ESA-86-97442) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11.50

The feasibility of direct-write electron beam lithographic systems for wafer scale integration was investigated. Electron-beam induced conductivity of silicon dioxide can be used to charge polysilicon floating gates in integrated circuits; a high programming voltage on the chip is not required. The information stored as a charge is nonvolatile and can be used to activate spare modules during a configuration process of a wafer scale system. Direct-write electron beam exposure systems are most suited for this programming. Electron-beam programmable cells were designed using a standard polygate CMOS-process. ESA

N86-31807# Institut National Polytechnique, Grenoble (France).
THE FUNCTIONAL TEST OF COMPLEX INTEGRATED CIRCUITS Ph.D. Thesis [LE TEST FONCTIONNEL DE CIRCUITS INTEGRES COMPLEXES]
Catherine Belion 1984 293 p In FRENCH
(ESA-86-97289) Avail: NTIS HC A13/MF A01

A multilevel automatic generation of test sequences is proposed. The procedure starts by considering the set of functional parameters and the fine structure of the electronic modules composing the circuit. The method may be considered related to automatic software testing or automata identification methods. A functional microprocessor test procedure is described. The method takes into account the synchronous input-signals and allows the automatic generation of test programs. A specific high level computer language was developed for that purpose and is described. The 68000 microprocessor was described in that language and its test programs generated. The elements implementing the system are detailed. ESA

N86-31808# Institut National Polytechnique, Grenoble (France).
SPECIFICATION AND FUNCTIONAL SIMULATION OF COMPLEX CIRCUITS: THE CADOC SYSTEM Ph.D. Thesis [SPECIFICATION ET SIMULATION FONCTIONNELLES DE CIRCUITS COMPLEXES: LE SYSTEME CADOC]
Michel CrastedePaulet 1985 324 p In FRENCH
(ESA-86-97296) Avail: NTIS HC A14/MF A01

The CADOC language, a multilevel functional language able to manage the specification, tests, descriptions or simulation of VLSI integrated circuits is described. It is used in a computer aided design system. The application to the functional description of MOS technology devices is detailed. ESA

N86-31809# Institut National Polytechnique, Grenoble (France).
PROCESSING AND CORRECTION OF VLSI CIRCUIT IMAGES OBTAINED WITH A SCANNING ELECTRONIC MICROSCOPE Ph.D. Thesis [CORRECTION AND TRAITEMENT D'IMAGES DES CIRCUITS VLSI ISSUES D'UN MICROSCOPE ELECTRONIQUE A BALAYAGE]
Alireza Zolghadrasli 1985 120 p In FRENCH
(ESA-86-97297) Avail: NTIS HC A06/MF A01

A computer system for visualizing the evolution of the internal potentials of working integrated circuits, and the details of the image processing to obtain useful images are presented. The program developed for a digital Minc microcomputer is given. It is shown that this technique is especially adapted to development work for VLSI prototypes. ESA

N86-31810# Institut National Polytechnique, Grenoble (France).
FUNCTIONAL TESTS OF DIGITAL INTEGRATED CIRCUITS Ph.D. Thesis [TEST FONCTIONNEL DES CIRCUITS INTEGRES DIGITAUX]
Eric Archambeau 1985 249 p In FRENCH
(ESA-86-97301) Avail: NTIS HC A11/MF A01

Methods to generate test vectors for large scale integration circuits are presented. The rules of testable circuit design are discussed. Heuristic rules are introduced to apply the general testability theory to generate test vectors. Following the definition of pseudo-exhaustive tests, the difficulties of the optimal partition problem are evaluated and an efficient partition method is proposed. The potential increase in test rapidity and efficiency is discussed. ESA

N86-31811# Technische Hogeschool, Delft (Netherlands). Lab. voor Informatietheorie.
LINEAR FILTER THEORY Annual Report, 1984-1985 [LINEAIRE FILTERTHEORIE]
J. Biemond 1985 65 p In DUTCH
(ESA-86-97391) Avail: NTIS HC A04/MF A01

The linear least squares estimating theory for statistical signal processing is discussed. Concepts of system theory necessary for filter derivations, e.g., impulse response, convolution integrals, state equations, and spectral factorization are considered. Signal estimating with Wiener and Kalman filters and an optimal filter variant, i.e., adaptive noise cancelling is described. ESA

N86-31812# Conradty (C.) G.m.b.H. und Co. K.G., Nuernberg (West Germany).
DIMENSIONALLY STABLE ELECTRODES FOR USED SALT ELECTROLYSIS (SUBSTITUTE FOR PETROLEUM COKE) Final Report, Dec. 1984
Christine Zoellner and Klaus Kahl Bonn, West Germany BMFT Dec. 1985 106 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-T-85-186; ISSN-0340-7608; ESA-86-97450) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.50

An electrode system for anodes in aluminum fused salt electrolysis was developed and tested as regards electrochemical efficiency, corrosion resistance, possible design of large-scale anodes, and production costs. The anode, a water-cooled combination electrode, consists of a metal upper section incorporating a cooling system and serving as a current carrier and distributor, with refractory graphite protective elements, and a ceramic active lower section. The electrode system allows savings of raw materials of 0.655 ton of fuel per ton of aluminum produced. Operation of the aluminum electrolysis with inert anodes improves working conditions and environmental quality. The interpolation distance can be reduced with inert cathodes. ESA

N86-31813# AEG-Telefunken, Backnang (West Germany). Weltverkehr und Kabeltechnik Fachbereich Raumfahrt.
HIGH VOLTAGE TECHNOLOGY FOR A TRAVELING WAVE TUBE ELECTRONIC POWER CONDITIONER (TWT-EPC) FOR A SYNTHETIC APERTURE RADAR (SAR) Final Report, Dec. 1981
Klaus-Heinrich Geissler, Rolf Bernhard, and Reinhard Seeliger Bonn, West Germany BMFT Dec. 1985 129 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-015; ISSN-0170-1339; ESA-86-97459) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27

A satellite-borne synthetic aperture radar system with an output power of 5 to 20 kW was studied to determine electronic power conditioning (EPC) requirements. The EPC technology is described. The selection of the insulating materials, the test procedures, and switching principles for an emitting amplifier tube are reviewed. The electrical and mechanical load limits and the thermal criteria relative to the aperture width and voltage are presented. The insulating systems and partial discharge in ac and dc were tested, and acceleration tests performed. A power section comprising an

inverter, a high voltage transformer and rectifier and a capacitor bank was built and tested in thermal vacuum under various operating conditions. It confirms the reliability of the high voltage technology and its applicability in the design of flight hardware. ESA

N86-31814# Technische Hogeschool, Eindhoven (Netherlands). Vakgroep der Directe Energieomzetting.
A NEW MODEL FOR THE RELATION BETWEEN CONDUCTIVITY AND CURRENT IN AN MHD GENERATOR [EEN NIEUW MODEL VOOR HET VERBAND TUSSEN HET GELEIDINGSVERMOGEN EN DE STROOM IN EEN MHD GENERATOR]
J. C. W. Sars Nov. 1984 117 p In DUTCH
(EG/84/373; ESA-86-97527) Avail: NTIS HC A06/MF A01

A model for the calculation of the induced current in an MHD generator was derived. Starting from voltage probe measurements, relations between conductivity and current, and voltage drop and current were derived and inserted in the Kirchhof law. For certain values of velocity, the magnetic field, and the load resistance, the impossibility of a certain segment to conduct current despite an induced voltage greater than 0 is predicted. The whole voltage falls over the internal resistance. The whole generator channel in X-direction was calculated with a correction for the Hall Short Circuit (HSC), measured and calculated values agree well. The HSC also explains the current reduction in the second half of the generator. ESA

N86-31815# Technische Hogeschool, Eindhoven (Netherlands). Vakgroep Telecommunicatie EC.
A 2 MBIT/SEC MODEM AT 70 MHz BASED ON THE TAMED FREQUENCY MODULATION (TFM) PRINCIPLE [EEN 2 MBIT/S MODEM OP 70 MHLCZ VOLGENS HET TAMED FREQUENCY MODULATION PRINCIPLE]
M. J. Verhaegh May 1984 102 p In DUTCH
(ESA-86-97537) Avail: NTIS HC A06/MF A01

A tamed frequency modulation (TFM) digital phase modulation method modem was designed and realized for satellite communication experiments. The method offers possibilities for bandwidth and power efficiency, and the use of nonlinear amplifiers, which makes it apt for satellite and mobile radio communication. Normal and coherent quadrature modulators are described. The carrier wave regain, necessary for coherent detection, is achieved with a heterodyne phase locked loop. Measured bit error rate as a function of the signal to noise ratio is given. ESA

N86-31816# European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL RESEARCH ON OPEN RESONATORS
Erich Kemptner Nov. 1985 134 p Original language document was announced as N85-31414
(ESA-TT-931; DFVLR-FB-85-12; ESA-86-97574) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, West Germany DM 35.50

The scalar integral equations for open resonators are derived. The complex eigenvalue determines power loss and phase shift per transit. The eigenfunction represents the field distribution on a reflector. This distribution is used to calculate the field inside the resonant volume. An experimental setup to measure the resonant frequencies and the quality factors was designed. The field was scanned with small spheres. The quality, the resonant frequency and the amplitude of the signal were recorded simultaneously. Data agree with the theoretical ones. ESA

N86-31817# European Space Agency, Paris (France).
DIRECT-COUPLED CAVITY FILTERS WITH IRISES OF ARBITRARY THICKNESS
Manfred Weisser and Karl Hans Waegel Oct. 1985 69 p Original language document was announced as N86-10412
(ESA-TT-939; DFVLR-FB-85-14; ESA-86-97576) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 21

The transmission characteristics of symmetrical waveguide filters were investigated. The thickness of the irises is taken into account. The calculations are based on an exact mode matching method. In the frequency range of the X-band one, two, three, four, and six-cavity filters are analyzed and parameters such as aperture, thickness of irises, and cavity length are changed. The results of the measurements are in good agreement with the computed transmission characteristics. ESA

N86-31818# Technische Hogeschool, Eindhoven (Netherlands). Vakgroep Automatisch Systeem Ontwerpen (ES).
FLOOR PLANNING AND NET ASSIGNMENT IN LAYOUT COMPILATION
Lukas vanGinneken 18 Mar. 1985 35 p
(ESA-86-97530) Avail: NTIS HC A03/MF A01

The layout design of a silicon compiler is reviewed. The environment in terms of input, output and data bases is discussed. A complete design process is outlined and interpretated as an application of the principles of stepwise refinement to the design of complex integrated circuits. The rationale behind the chosen system decomposition, accepted restraints, and methods for cell assembling is emphasized. An annealing algorithm is summarized. The use of the algorithm for floor plan design, used state spaces and moves, and the way the score function is computed are described. An automatic control schedule is described. A method for the global wiring of custom layout of ICs is given. ESA

N86-31819# Institut Franco-Allemand de Recherches, St. Louis (France).
MULTIPLE PSEUDOSPARK SWITCH (MUPS) [MULTI-PSEUDOFUNKENSCHALTER (MUPS)]
G. Mechtersheimer and R. Kohler 28 Jun. 1986 14 p In GERMAN
(ISL-R-110/85; ESA-86-97624) Avail: NTIS HC A02/MF A01

A multiple pseudospark commutator was developed. Several pseudospark gaps in parallel can be synchronously ignited via triggering by a pulsed gaseous discharge with low intensity. A multiple pseudospark commutator consisting of 10 linearly disposed pseudospark gaps was integrated in a capacitor with low-inductance plates. The capacitance to be switched was 5 nF; the inductance of the circuit was 1.65 nH, the contribution of the MUPS was less than 0.5 nH. The repartition of the current among the 10 discharge channels allows a current increase rate of 2.4 times 10 to the 12th power A/s at a switched voltage of 15 kV. This is a significant improvement compared to the value of 5 times 10 to the 11th power A/s obtained with a single pseudospark gap. The current capacity of the switch increases with the number of pseudospark gaps ignited in parallel. ESA

N86-31820# Technische Hogeschool, Delft (Netherlands). Laboratory for Pulse and Digital Electronics.
AN NMOS EVALUATION CIRCUIT
J. H. A. deRijk Jun. 1985 88 p
(Rept-IR-01; ESA-86-98040) Avail: NTIS HC A05/MF A01

An electrical evaluation circuit was designed for the 700 Angstrom LOCOS N-MOS E-D process. The smallest structure in the circuit was 6 micron. Two runs were made, the first having the code IC370, and the second IC372. A 4 micron (IC377) type was developed. The IC370 and the IC372 are 3.3 asterisk 3.3 um circumflex 2. The IC377 is 2.2 asterisk 2.2 um circumflex 2. The circuit extracts electrical and process-parameters. Both types of parameters can be used for circuit simulation, while the extracted process-parameters can be used to evaluate the process. ESA

N86-31821# Kema N.V., Arnhem (Netherlands). Dept. of Physical Research.
A CONSERVATIVE RATING PROCEDURE FOR CYCLICALLY LOADED, BURIED CABLES
G. Koopmans and A. J. vanLoon, ed. 1985 10 p
(S/T-Rept-Vol-3-No-9; ISBN-90-353-0032-7; ISSN-0167-8590; B8665325; ESA-86-98063) Avail: NTIS HC A02/MF A01

A conservative and simple current-rating algorithm for buried power cables subjected to a cyclically varying load is presented. The algorithm is based on the assumption that the moisture distribution in the soil is stationary during load variations and that

it is determined by the spatial distribution of the maximum heat flux. This assumption is reasonable in view of the hysteretic nature of moisture retention by soils. Only one Fourier component of the heat-loss variation is considered in the algorithm. Applications where adapted equations of Philip and De Vries are used to describe heat and moisture transfer are shown. The critical temperatures found for drying-out of the soil hardly differ for stationary and cyclic loads. The maximum allowed average load decreases with increasing load variation. At maximum load, the maximum current occurring during a cycle is higher than the maximum stationary load allowed. ESA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-31822 Societe Nationale Industrielle Aerospatiale, Cannes (France).
VAPOR CONTROLLED HEAT PIPE (VCHP) TELECOMMUNICATIONS PANEL. PERFORMANCES EVOLUTION AFTER FOUR YEARS OF LIFE TESTING
B. Moschetti 1986 7 p
(SNIAS-861-440-106; ESA-86-97614) Avail: NTIS HC A02

Endurance tests were carried out to verify the long term performance of a spacecraft heat pipe based thermal control prototype unit. Thermal regulation was measured periodically under space vacuum conditions. Passive and active feedback loops were verified. The prototype and the test procedures are described. After 7 years of testing no degradation or performance losses are found. ESA

N86-31823*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF BOUNDARY LAYERS. PART 2: RIBBON-INDUCED TRANSITION IN BLASIUS FLOW
Philippe Spalart and Kyung-Soo Yang (Stanford Univ., Calif.) Feb. 1986 27 p
(NASA-TM-88221; A-86072; NAS 1.15:88221) Avail: NTIS HC A03/MF A01 CSCL 20D

The early three-dimensional stages of transition in Blasius boundary layers are studied by numerical solution of the Navier-Stokes equations. A finite-amplitude two-dimensional wave and random low-amplitude three-dimensional disturbances are introduced. Rapid amplification of the three-dimensional components is observed and leads to transition. For intermediate amplitudes of the two-dimensional wave the breakdown is of subharmonic type, and the dominant spanwise wave number increases with the amplitude. For high amplitudes the energy of the fundamental mode is comparable to the energy of the subharmonic mode, but never dominates it; the breakdown is of mixed type. Visualizations, energy histories, and spectra are presented. The sensitivity of the results to various physical and numerical parameters is studied. Agreement with experimental and theoretical results is discussed. Author

N86-31824*# Stanford Univ., Calif.
A 3-COMPONENT LASER-DOPPLER VELOCIMETER DATA ACQUISITION AND REDUCTION SYSTEM
L. C. Rodman, J. H. Bell, and R. D. Mehta Jan. 1986 82 p
(Contract NCC2-294)
(NASA-CR-177390; NAS 1.26:177390) Avail: NTIS HC A05/MF A01 CSCL 20D

This report describes a laser Doppler velocimeter capable of measuring all three components of velocity simultaneously in low-speed flows. All the mean velocities, Reynolds stresses, and higher-order products can then be evaluated. The approach followed is to split one of the colors used in a 2-D system, thus creating a third set of beams which is then focused in the flow from an off-axis direction. The third velocity component is computed from the known geometry of the system. In this report, the laser optical hardware and the data acquisition electronics are described in detail. In addition, full operating procedures and listings of the software (written in BASIC and assembly languages) are also included. Some typical measurements obtained with this system in a vortex/mixing layer interaction are presented and compared directly to those obtained with a cross-wire system. Author

N86-31825*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CALCULATIONS OF THE STABILITY OF SOME AXISYMMETRIC FLOWS PROPOSED AS A MODEL OF VORTEX BREAKDOWN Final Report
Nessan Mac Giolla Mhuiris May 1986 37 p Submitted for publication
(NASA-CR-178124; NAS 1.26:178124; ICASE-86-34) Avail: NTIS HC A03/MF A01 CSCL 20D

The term vortex breakdown refers to the abrupt and drastic changes of structure that can sometimes occur in swirling flows. It was conjectured that the bubble type of breakdown can be viewed as an axisymmetric wave traveling upstream in a primarily columnar vortex flow. In this scenario the wave's upstream progress is impeded only when it reaches a critical amplitude and it loses stability to some nonaxisymmetric disturbance. The stability of some axisymmetric wavy flows to three dimensional disturbances, viewing the amplitude of the wave as a bifurcation parameter is examined. The stability of a set of related columnar vortex flows, constructed by taking the two dimensional flow at a single axial location and extending it throughout the domain without variation, is investigated. The method used will be to expand the perturbation velocity in a series of divergence free vectors which ensures that the continuity equation for the incompressible fluid is satisfied exactly by the computed velocity field. Projections of the stability equation onto the space of inviscid vector fields eliminated the pressure term from the equation and reduces the differential eigen problem to a generalized matrix eigen problem. Results are presented both for the one dimensional, columnar vortex flows and also for the wavy bubble flow. Author

N86-31826*# Michigan Univ., Ann Arbor. Heat Transfer Lab.
MODELING OF ZERO GRAVITY VENTING: STUDIES OF TWO-PHASE HEAT TRANSFER UNDER REDUCED GRAVITY Final Report
Herman Merte, Jr. Aug. 1986 66 p
(Grant NAG3-403)
(NASA-CR-179662; NAS 1.26:179662) Avail: NTIS HC A04/MF A01 CSCL 20D

The objective is to predict the pressure response of a saturated liquid-vapor system when undergoing a venting or depressurization process in zero gravity at low vent rates. An experimental investigation of the venting of cylindrical containers partially filled with initially saturated liquids was previously conducted under zero-gravity conditions and compared with an analytical model which incorporated the effect of interfacial mass transfer on the ullage pressure response during venting. A new model is presented to improve the estimation of the interfacial mass transfer. Duhammel's superposition integral is incorporated to approximate the transient temperature response of the interface, treating the liquid as a semi-infinite solid with conduction heat transfer. Account is also taken of the condensation taking place within the bulk of a saturated vapor as isentropic expansion takes place. Computational results are presented for the venting of R-11 from a given vessel and initial state for five different venting rates over a period of three seconds, and compared to prior NASA experiments. An improvement in the prediction of the final pressure takes place, but is still considerably below the measurements. Author

N86-31827*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH SPEED VISCOUS FLOW CALCULATIONS ABOUT COMPLEX CONFIGURATIONS

Denny S. Chaussee Apr. 1986 21 p
(NASA-TM-88237; A-86199; NAS 1.15:88237) Avail: NTIS HC A02/MF A01 CSCL 20D

Applications of the NASA Ames Parabolized Navier-Stokes (PNS) code to a variety of complex generic configurations is presented. The algorithm, boundary conditions, initial conditions, and grid generators are discussed as applied to these configurations. The PNS code was used as the mainline procedure to numerically simulate the viscous supersonic flow over these generic configurations. The turbulence model that was used in this study is the Baldwin-Lomax model. The boundary conditions are the usual viscous no slip at the wall, and a characteristic procedure is used to fit the bow shock wave which is the outermost boundary. An elliptic grid generator is employed to discretize the flow domain. In addition, an equilibrium air capability has been incorporated into the code. It uses the curve fits of Tannehill, et al. The flow regimes vary from a Mach number of 2 up to 25. Both laminar and turbulent flow are considered. Varying angles of attack have also been computed. Configurations vary from simple cone-type bodies to lifting winged bodies, such as the space shuttle or the generic supersonic cruise fighter. Author

N86-31828*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NUMERICAL QUADRATURE METHODS FOR INTEGRALS OF SINGULAR PERIODIC FUNCTIONS AND THEIR APPLICATION TO SINGULAR AND WEAKLY SINGULAR INTEGRAL EQUATIONS Final Report
Avram Sidi (Technion - Israel Inst. of Tech., Haifa) and Moshe Israeli Jul. 1986 36 p Submitted for publication
(Contract NAS1-17070)
(NASA-CR-178151; ICASE-86-50; NAS 1.26:178151) Avail: NTIS HC A03/MF A01 CSCL 20D

High accuracy numerical quadrature methods for integrals of singular periodic functions are proposed. These methods are based on the appropriate Euler-Maclaurin expansions of trapezoidal rule approximations and their extrapolations. They are used to obtain accurate quadrature methods for the solution of singular and weakly singular Fredholm integral equations. Such periodic equations are used in the solution of planar elliptic boundary value problems, elasticity, potential theory, conformal mapping, boundary element methods, free surface flows, etc. The use of the quadrature methods is demonstrated with numerical examples. Author

N86-31829# Wisconsin Univ., Madison. Mathematics Research Center.
INFLOW BOUNDARY CONDITIONS FOR STEADY FLOWS OF VISCOELASTIC FLUIDS WITH DIFFERENTIAL CONSTITUTIVE LAWS Technical Summary Report
Michael Renardy Feb. 1986 10 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-84-51761)
(AD-A167452; MRC-TSR-2916) Avail: NTIS HC A02/MF A01 CSCL 20/4

Steady flows of viscoelastic fluids can not be uniquely determined by imposing boundary conditions only for the velocities as in the Newtonian case. The reason for this is that the fluids have memory, and therefore the flow inside the domain is affected by what happened before the fluid entered the domain. This leads to the need for extra boundary conditions at an inflow boundary. The nature of these inflow boundary conditions has not been analyzed previously, and it is certainly dependent on the constitutive law. In this paper, we look at the special case of differential constitutive relations with a single relaxation mode. We consider steady transverse flows across a strip which are small perturbations of a flow with constant velocity. It turns out that in this case two extra inflow boundary conditions are required in two dimensions, and four in three dimensions. This is what would be expected from an analysis of characteristics, but it contradicts the belief of many rheologists that it is possible to prescribe the extra stress at an inflow boundary. The problem studied here is of potential relevance for numerical simulations of steady flows. Many of the flows currently simulated are on infinite domains. Numerically, these domains are truncated, and on the inflow boundary of the truncated domain people usually prescribe the extra stress. According to the analysis in this paper, this is an overdetermined problem, and therefore errors must be expected from this procedure. GRA

N86-31830# Wisconsin Univ., Madison. Mathematics Research Center.
ON TRAVELLING-WAVE SOLUTIONS TO SYSTEMS OF CONSERVATION LAWS WITH SINGULAR VISCOSITY Technical Summary Report
Howard Prue and Richard Sanders Jan. 1986 34 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-82-00676)
(AD-A167518; MRC-TSR-2906) Avail: NTIS HC A03/MF A01 CSCL 20/4

The method of vanishing artificial viscosity is used to obtain smooth, large data travelling wave solutions to a class of conservation laws with semidefinite viscosity. The one dimensional Navier Stokes equations serve as an illustrating example. GRA

N86-31831# Wisconsin Univ., Madison.
STEEP GRAVITY WAVES: HAVELOCK'S METHOD REVISITED Summary Report
Jean-Marc Vanden-Broeck Apr. 1986 11 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-80-01960)
(AD-A167520; MRC-TSR-2933) Avail: NTIS HC A02/MF A01 CSCL 20/4

Gravity waves propagating at the surface of a fluid of infinite depth are considered. The problem is formulated in terms of a series expansion due to Havelock. The series is truncated after a finite number of terms and the unknown coefficients are found by collocation. It is shown that this simple numerical procedure yields accurate results for waves of arbitrary steepness. GRA

N86-31832# Wisconsin Univ., Madison.
A FREE STREAMLINE MODEL FOR A RISING BUBBLE Summary Report
Jean-Marc Vanden-Broeck Mar. 1986 19 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-80-01960)
(AD-A167535; MRC-TSR-2921) Avail: NTIS HC A02/MF A01 CSCL 20/4

The motion of a two dimensional bubble rising at a constant velocity in an unbounded fluid is solved by series truncation. It is assumed there is a wake of stagnant liquid extending to infinity below the bubble. Both the effects of gravity g and surface tension T are taken into account. It is shown that the problem is characterized by a continuum of solutions for $T = 0$ and by a discrete set of solutions when T is greater than 0. In addition a unique solution is obtained in the limit as the surface tension approaches zero. The corresponding profile of the bubble is found to be in good agreement with experimental data. The present paper describes example of such flow. Consider the motion of a two dimensional bubble rising at a constant velocity in an unbounded fluid. It is assumed there is a wake of stagnant liquid extending to infinity below the bubble. Both the effects of gravity and surface tension are taken into account. It is found that this problem is also characterized by a continuum of solutions when surface tension is neglected and by a discrete set of solutions when surface tension is taken into account. Moreover it is shown that a unique solution is obtained in the limit as the surface tension tends to zero. The corresponding profile of the bubble is found to be in good agreement with experimental data. GRA

N86-31833# Wisconsin Univ., Madison. Mathematics Research Center.
SOLITARY AND PERIODIC WAVES IN SWIRLING FLOW Summary Report
Scott A. Markel Mar. 1986 30 p
(Contract DAAG29-80-C-0041)
(AD-A167538; MRC-TSR-2922) Avail: NTIS HC A03/MF A01 CSCL 20/4

The study of vortex breakdown gives rise to an interest in waves in swirling flow. Our interest is centered on the existence of both solitary and periodic internal waves. In this report a model physical problem is studied in a mathematically exact formulation.

We restrict our attention to an incompressible, inviscid fluid swirling through a right cylinder of infinite length and finite radius. Our theory, which is not restricted to small amplitudes, predicts both waves of elevation and depression, depending on the angular velocity (swirl) distribution and the velocity distribution at infinity. Just as for the classical surface solitary waves, these internal solitary waves are single crested, symmetric, and decay exponentially away from the crest. Hence they represent disturbances of essentially finite extent. Variational techniques and the theory of rearrangements are used to demonstrate these qualitative features. Moreover, we show that the solitary internal wave arises as a limit of periodic internal waves of increasing wave lengths. Variational techniques are used to demonstrate that the Euler equations possess solutions that represent progressing waves of permanent form. Moreover, internal solitary wave solutions are shown to arise as the limiting forms of internal periodic waves as the period length becomes unbounded. GRA

N86-31834# Purdue Univ., West Lafayette, Ind. School of Mechanical Engineering.
LASER VELOCIMETER MEASUREMENTS AND ANALYSIS IN TURBULENT FLOWS WITH COMBUSTION. PART 4: TWO-COMPONENT COLD-FLOW MEASUREMENTS Final Report, 1 Jan. 1981 - 2 Oct. 1984
H. D. Thompson, Warren H. Stevenson, and R. D. Gould Mar. 1986 36 p
(Contract F33615-81-K-2003)
(AD-A167554; AFWAL-TR-82-2076-Pt-4) Avail: NTIS HC A03/MF A01 CSCL 20/4

A unique two component, two color Laser doppler Velocimeter (LDV) has been designed and built. The system includes Bragg cell modulators in all four beams, and a correction lens system to correct for the aberration induced by the cylindrical quartz test section. A dedicated PDP 11/40 mini-computer with DMA capability is used for data collection, storage, and processing. Two component (axial and radial) velocity measurements have been made in the turbulent flow field following an axisymmetric sudden expansion. Mean streamwise and radial velocity and turbulence intensity measurements were made. Reynolds stresses were computed. GRA

N86-31835# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF VARIABLE PROPERTIES IN FILM COOLED TURBULENT BOUNDARY LAYERS M.S. Thesis
Alfred F. Walz, Jr. Mar. 1986 76 p
(AD-A167716) Avail: NTIS HC A05/MF A01 CSCL 20/4

The effects of variable properties on heat transfer in a film-cooled turbulent boundary layer were investigated. A new procedure was developed to deduce adiabatic effectiveness from heat transfer coefficients based on the wall to freestream temperature difference, where both are representative of variable property flow conditions. The new technique was shown to be valid using data from the literature for injection into a turbulent boundary layer from one and two rows of injection holes. From these results, the variation of the coolant to mainstream density ratio was shown to have a significantly greater effect on heat transfer than variations of viscosity and thermal conductivity. GRA

N86-31836# Texas A&M Univ., College Station.
FORMULATION OF NUMERICAL METHODS USED IN THE XYZ THREE-DIMENSIONAL POTENTIAL FLOW PROGRAM M.S. Thesis
William J. Beary, Jr. May 1986 96 p
(Contract N00228-85-G-3303)
(AD-A168167) Avail: NTIS HC A05/MF A01 CSCL 20/4

The calculation of non-lifting potential flow about arbitrary three dimensional bodies is examined in detail with specific interest in the XYZ Potential Flow program. The program uses a surface singularity distribution to solve the Neumann boundary value problem by means of a source panel method assuming a flat element with a constant source density over the area of the element. Boundary conditions are applied at control points on the elements producing a system of linear equations for the source density. When the source density is known, velocities and pressure coefficients may be calculated. The main purpose of this paper is to present the details of the approximation of an arbitrary three dimensional body using quadrilateral elements, and to provide a detailed derivation of the exact source panel integrations in order to gain insight for future research at Texas A&M University. A variation of the Hess method of surface discretization using quadrilateral source panels is described in detail as it is used in the XYZ Potential Flow program. The exact source panel integrations are derived in detail. GRA

N86-31837# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
DIFFUSION OF GASES IN POROUS SOLIDS: SIMULATION AND MEASUREMENT Final Technical Report
J. W. Evans Jan. 1986 47 p
(Contract DE-FG22-82PC-50796)
(DE86-005380; DOE/PC-50796/T9) Avail: NTIS HC A03/MF A01

The theoretical part of this investigation has achieved its objective. By means of the Monte Carlo simulation the Knudsen diffusion of gases in Swiss cheese solid has been studied and shown to yield results similar to studies on the cannonball solids that were the subject of a prior investigation at Berkeley. A correlation was developed that permits a prediction of the Knudsen diffusion coefficient of any gas in any porous solid with a monodisperse pore size distribution. The Monte Carlo technique has also been used to simulate ordinary diffusion in porous solids of both Swiss cheese and cannonball types, and a predictive correlation developed for this regime also. An unanticipated result of this study was the recognition of the analogy between diffusion of a gas in a porous solid and other transport phenomena in heterogeneous media. The Berkeley investigation has drawn together data from the Monte Carlo simulation, empirical predictive equations from the diffusion literature and classical results from theoretical physics on conduction in hetergeneous media. Finally the Monte Carlo technique was extended to porous solids with a bidisperse pore structure and it was again shown that the results are consistent with expectations. The experimental phase of this investigation has been successful in measuring the viscosities and diffusivities of a number of gases over a wide range of temperature of practical interest. The experimental results have been in agreement with the experimental data of others (mostly at lower temperature) and with theoretical predictions, in most instances. DOE

N86-31838# Dynatech R/D Co., Cambridge, Mass.
PLASTIC FILM HEAT EXCHANGER DEVELOPMENT PROJECT
E. C. Guyer, D. L. Brownell, and M. K. Gollin 14 Apr. 1986 30 p
(Contract DE-AC07-84ID-12550)
(DE86-009258; DOE/ID-12550/T1) Avail: NTIS HC A03/MF A01

This report presents the progress that has been achieved in the development of the plastic film heat exchanger system (PFHX). An earlier report presented the general performance and design characteristics of a steam recovery PFHX. This report reviews some additional material selection possibilities for the film surfaces and describes a prototype design of a plastic film heat exchange element. Also the facility for the elevated temperature testing of this element design is described and the test plan is presented. DOE

N86-31839# Lawrence Livermore National Lab., Calif.
PREDICTABILITY OF RAYLEIGH-TAYLOR INSTABILITY
J. A. Viecelli 27 Mar. 1986 19 p
(Contract W-7405-eng-48)
(DE86-009932; UCID-20739) Avail: NTIS HC A02/MF A01

Numerical experiments modeling the Rayleigh Taylor instability are carried out using a two-dimensional incompressible Eulerian hydrodynamic code VFTS. The method of integrating the Navier-Stokes equations including the viscous terms is similar to that described in Kim and Moin, except that Lagrange particles have been added and provision for body forces is given. The Eulerian method is 2nd order accurate in both space and time, and the

Poisson equation for the effective pressure field is solved exactly at each time step using a cyclic reduction method. DOE

N86-31840# Lawrence Livermore National Lab., Calif.
EULERIAN TRANSPORT IN GENERAL ORTHOGONAL CURVILINEAR COORDINATES
K. Sinz Oct. 1985 15 p
(Contract W-7405-eng-48)
(DE86-010266; UCRL-53683) Avail: NTIS HC A02/MF A01

Eulerian fluid transport in general orthogonal curvilinear coordinates is calculated in the KEYSTONE code. Prescriptions are given for the volume and area calculations that allow for the curvature of the zones, as well as the complications introduced by extreme aspect ratios of the zone sizes. Singularities in the mesh are considered, and metrics are obtained from a numerically specified mesh. Many of the demonstrated techniques are independent of the coordinate system and could be used in standard Lagrangian codes. DOE

N86-31841# Oak Ridge Gaseous Diffusion Plant, Tenn.
CALCULATION OF HEAT FLUX THROUGH A WALL CONTAINING A CAVITY: COMPARISON OF SEVERAL MODELS
J. E. Park, J. R. Kirkpatrick, J. N. Tunstall, and K. W. Childs Feb. 1986 30 p
(Contract DE-AC05-84OT-21400)
(DE86-010348; K/CSD/TM-59) Avail: NTIS HC A03/MF A01

This paper describes the calculation of the heat transfer through the standard stud wall structure of a residential building. The wall cavity contains no insulation. Results from five test cases are presented. The first four represent progressively more complicated approximations to the heat transfer through and within a hollow wall structure. The fifth adds the model components necessary to severely inhibit the radiative energy transport across the empty cavity. Flow within the wall cavity is calculated from the Navier-Stokes equations and the energy conservation equation for an ideal gas using an improvement to the Implicit-Compressible Eulerian (ICE) algorithm of Harlow and Amsden. An algorithm is described to efficiently couple the fluid flow calculations to the radiation-conduction model for the solid portions of the system. Results indicate that conduction through still plates contributes less than 2% of the total heat transferred through a composite wall. All of the other elements (conduction through wall board, sheathing, and siding; convection from siding and wallboard to am bients; and radiation across the wall cavity) are required to accurately predict the heat transfer through a wall. Addition of a foil liner on one inner surface of the wall cavity reduces the total heat transferred by almost 50%. DOE

N86-31842# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
CRITICAL FLOW THROUGH SMALL PIPE BREAKS Final Report
J. L. Anderson and R. L. Benedetti May 1986 169 p
(Contract DE-AC07-76ID-01570)
(DE86-010907; EPRI-NP-4532) Avail: NTIS HC A08/MF A01

A series of experiments have been performed investigating the phenomena of liquid entrainment and vapor pull-through at a tee junction between a horizontal pipe and a small branchline. These experiments were performed under conditions of stratified steam-water flow at 3.4, 4.4, and 6.2 MPa in the 28.4 cm diameter mainline, and critical flow through a nozzle installed in the branchline. Two orientations of the branchline were investigated: horizontal and vertical downflow. This report documents the experimental program, presents the data obtained, and discusses correlations for predicting the levels at which the onset of vapor pull-through and liquid entrainment occur and correlations for predicting the flow quality into the branchline. DOE

N86-31843# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF ADVANCED THERMAL INSULATION FOR APPLIANCES Progress Report, Jul. 1984 - Jun. 1985
D. W. Yarbrough, F. J. Weaver, R. S. Graves, and D. L. McElroy May 1986 50 p
(Contract DE-AC05-84OR-21400)
(DE86-011357; ORNL/CON-199) Avail: NTIS HC A03/MF A01

Numerical simulations of the radial heat flow apparatus used to measure the apparent thermal conductivity (k sub a) of powders with high thermal resistance (R) showed that heat losses from the ends of the cylindrical specimen and core heater cause the k sub a of the specimen to be greater than the true value. This effect is large when high-R powders are tested. A radial apparatus 91 cm in length, ORNL-5, was constructed and used to reduce uncertainties introduced by end losses. ORNL-5 was used to test mixtures of low-cost coarse fumed-silica particles and relatively uniform, but expensive, fine fumed-silica particles. R-values per inch (2.54 cm) in air near 7 have been measured for pure fumed-silica powders. The thermal resistances of mixtures of coarse and fine powders were determined in the range 290 to 340°K at atmospheric pressure. Results show that R per inch depends on density and that R-values per inch greater than 5 can be achieved with such mixtures. R-values for a mixture of nominal 7-nm fine silica and coarse silica have been measured as a function of pressure near 300°K , and R per inch greater than 40 has been achieved in vacuum (<10 Pa). Linear heat flow measurements on evacuated rectangular panels showed that R per inch for the panels dropped from 16.8 to 15.9 in two years. DOE

N86-31844# Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Warmte- en Stromingsleer.
DAMPING FORCE EXERTED BY A VISCOUS MEDIUM UPON AN OSCILLATING CYLINDER [DEMPINGSKRACHT UITGEOEFEND DOOR EEN VISCEUS MEDIUM OP EEN OSCILLERENDE CYLINDER]
Thomas E. M. Meijssen Jul. 1984 73 p In DUTCH Sponsored by Koninklijke/Shell Exploratie en Produktie Lab., Rijswijk, Netherlands
(ESA-86-97374) Avail: NTIS HC A04/MF A01

The damping force which an unlimited, homogenous, incompressible, and viscous medium of certain density and kinematic viscosity exerts on an oscillating, infinitely long, stiff, circular cylinder was determined for offshore purposes. The oscillation amplitude is supposed much smaller than the cylinder radius. Three fields, characterized by order magnitudes of the so-called flow Reynolds number Rs, were distinguished: Rs much less than 1, Rs = 0(1), and Rs much greater than 1. Solutions for the related flow functions and corresponding expressions for the damping force are discussed. ESA

N86-31845# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
REENTRY BODY THREE-DIMENSIONAL FLOW COMPUTATION. (EULER AND PARABOLIZED NAVIER-STOKES) [CALCULS D'ECOULEMENT AUTOUR DE CORPS DE RENTREE (EULER ET NAVIER-STOKES PARABOLISE)]
Moules and Bourg 1986 29 p In FRENCH Presented at 22nd AAAF Colloque dAerodynamique Appliquee Lille, 13-15 Nov. 1985
(SNIAS-861-422-107; ESA-86-97595) Avail: NTIS HC A03/MF A01

The steady flow Navier-Stokes equations are written in nonorthogonal curvilinear coordinates where one of them is the general flow direction. The shock layer is completely viscous, considering a body at hypersonic velocity, at high altitude, with an incidence angle. Wind tunnel tests with helium and air were used to validate the method. The computation time for an axisymmetric body without incidence is 1 to 3 min using an IBM 3081 computer. Bodies with incidence require times of up to 1 hr. ESA

N86-31846# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
QUASI-SIMULTANEOUS CALCULATION OF STRONGLY INTERACTING VISCOUS FLOW
A. E. P. Veldman and J. P. F. Lindhout 21 Dec. 1984 13 p Presented at 3rd Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, Calif., 21-24 Jan. 1985
(Contract NIVR-1865)
(NLR-MP-84095-U; B8664361; ESA-86-97667) Avail: NTIS

HC A02/MF A01

The VISIAN analysis system for viscous-inviscid strong interaction is presented. The code is based on a quasi-simultaneous solution procedure for viscous and inviscid parts of the flow field. The viscous region is calculated with an extension of the classical boundary layer equations, featuring effects of normal pressure gradients and wake curvature. Results for separated laminar and turbulent flow past lifting Joukovsky airfoils are shown. ESA

N86-31847# National Aerospace Lab., Amsterdam (Netherlands). Theoretical Aerodynamics Dept.

ON WINGS AND KEELS (2)

J. W. Slooff May 1985 23 p Presented at 12th AIAA Ann. Symposium on Sailing (The Ancient Interface XII), Seattle, Wash., 21-22 Sept. 1985

(NLR-MP-85048-U; B8664739; ESA-86-97679) Avail: NTIS HC A02/MF A01

The physical mechanisms governing the hydrodynamics of sailing yacht keels and the parameters that, through these mechanisms, determine keel performance are discussed. It is concluded that due to the presence of the free water surface optimum keel shapes differ from optimum shapes for aircraft wings. Utilizing computational fluid dynamics analysis and optimization it is found that the performance of conventional keels can be improved significantly by reducing taper or even applying inverse taper (upside-down keel) and that decisive improvements in performance can be realized through keels with winglets. ESA

N86-31848# National Aerospace Lab., Amsterdam (Netherlands). Aerodynamics Div.

HYDRODYNAMIC INSTABILITIES AND SURFACE WAVES IN A FLOW OVER AN IMPEDANCE WALL

S. W. Rienstra 20 Jun. 1985 12 p Presented at IUTAM Symposium on Aero and Hydroacoustics, Lyon, 3-6 Jul. 1986 Submitted for publication

(NLR-MP-85053-U; B8664360; ESA-86-97680) Avail: NTIS HC A02/MF A01

A two dimensional analysis of the surface waves in a subsonic compressible uniform mean flow along an impedance wall is made. It is found that a maximum of four surface waves is possible. The regions of existence in complex impedance and wave number planes are given. One wave is found to travel upstream, while the others, one of which is an instability, propagate downstream. A Wiener-Hopf solution of plane wave scattering at a hard/soft discontinuity of the wall impedance in which the instability wave provides the additional degree of freedom to satisfy the Kutta condition at the impedance jump is constructed. The waves are limiting forms of irregular acoustic duct modes. ESA

N86-31849# European Space Agency, Paris (France).

INVESTIGATION OF DENSITY GRADIENT FLUCTUATIONS IN A TURBULENT JET BY MEANS OF THE LASER SCHLIEREN CROSSED-BEAM METHOD

Juergen Kompenhans, Hans R. Hoefer, and Sabine Rannenberg Oct. 1985 94 p Original language document was announced as N86-10027

(ESA-TT-942; DFVLR-FB-85-19; ESA-86-97578) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 25.50

Density gradient fluctuations within a round, turbulent jet were investigated at Mach numbers of 0.62 and 0.95 by laser Schlieren photography. Cross spectral density, coherence function, and phase velocity of the density gradient fluctuations were obtained using an arrangement of two crossed laser beams at various distances from the nozzle. Information on coherent structures in a jet was obtained, even at high Mach numbers. ESA

N86-31850# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.

CONDITIONED HOT-WIRE ANEMOMETER MEASUREMENTS AND STRUCTURAL ANALYSIS OF A TURBULENT SPOT IN A LAMINAR BOUNDARY LAYER [GECONDITIONEERDE SLOEID-RAADANEMOMETERMETINGEN EN STRUCTUURANALYSE VAN EEN TURBULENT SPOT OPGEWEKT IN EEN LAMINAIRE GRENSLAAG]

J. A. J. Martens Dec. 1985 101 p In DUTCH; ENGLISH summary

(MEAH-63; ESA-86-97712) Avail: NTIS HC A06/MF A01

The downstream development of a turbulent spot generated by a tripping wire in a laminar boundary layer was investigated in wind tunnel tests. Spot shape, vertical and lateral growth, ensemble-averaged structure, and isovelocity contours look similar to those of earlier experiments. The correlation coefficient in a turbulent spot is in good agreement with that in a turbulent boundary layer. A quadrant analysis of the product of the fluctuation velocity components in both directions shows that the second and fourth quadrant are the main contributors; their average fractional contributions are 80% and 75% respectively, while the first and third quadrant give a contribution of -30% and -25% respectively. The second quadrant does not dominate the fourth in a spot in contrast with a turbulent boundary layer. ESA

N86-31851# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Turbulenzforschung.

COHERENT VORTEX STRUCTURES IN THE WAKE OF A RIGID AND AN EXTERNALLY DRIVEN DISK Ph.D. Thesis - Technische Univ., Berlin, West Germany

Dietmar Scholz Dec. 1985 177 p In GERMAN; ENGLISH summary

(DFVLR-FB-86-04; ISSN-0171-1342; ESA-86-97587) Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 46

Coherent vortex structures were studied by comparing the large scale coherent flow structure in the wake of a rigid vertical circular disk with the turbulent structures behind the externally driven disk. The periodic vortex structures in these wakes can be decomposed via cross-correlation measurements with hot wires and microphones, particularly by using representations of coherences, phase relations, and azimuthal modes. In the very near wake, coherent periodic pressure oscillations due to pulsing of the recirculation bubble are superposed onto pressure fluctuations of the naturally occurring helical vortex structures which dominates in the entire flow region outside the recirculation bubble. ESA

N86-31852# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

NUMERICAL SIMULATION OF THE ACTIVE CONTROL OF LAMINAR-TURBULENT TRANSITION IN THE FLAT-PLATE BOUNDARY LAYER Ph.D. Thesis - Karlsruhe Univ., West Germany

Eckart Laurien Jan. 1986 121 p In GERMAN; ENGLISH summary

(DFVLR-FB-86-05; ISSN-0171-1342; ESA-86-97588) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany DM 36

Laminar-turbulent transition in the flat-plate boundary layer was simulated starting from Tollmein-Schlichting waves. Using the spatially periodic simulation model, the three-dimensional incompressible Navier-Stokes equations were solved by a spectral method. For the direction normal to the wall a Chebyshev collocation method was developed. The classical Klebanoff type and the subharmonic type were simulated. Up to the spike stage the results agree well with hot-wire measurements. The transition can be actively delayed by local two-dimensional suction blowing, if it is applied in the early stages. ESA

N86-31853# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Turbulenzforschung.

EXPERIMENTAL INVESTIGATION OF NOISE GENERATED BY TURBULENCE IN A PIPE FLOW BEHIND A DISCONTINUOUS AREA ENLARGEMENT Ph.D. Thesis - Technische Univ., Berlin, West Germany

Bernhard Stahl Nov. 1985 172 p In GERMAN; ENGLISH summary Sponsored by Deutschen Forschungsgemeinschaft

(DFVLR-FB-86-06; ISSN-0171-1342; ESA-86-97589) Avail: NTIS

HC A08/MF A01; DFVLR, Cologne, West Germany DM 36.50

Plane sound waves and higher acoustic modes, generated by turbulence occurring in the flow separation region downstream of a discontinuous enlargement in the circular cross-sectional area of a pipe, were investigated. Measurements of the axial phase velocity of pressure fluctuations show that turbulence fluctuations dominate in the region of flow separation just behind the jump in cross-sectional area, whereas further downstream the field is primarily determined by fluctuations of the aerodynamically generated sound waves. A decomposition of the pressure fluctuations shows that in the mixing region of the jet, the fluctuation energy is primarily distributed among several azimuthal components, while further downstream almost all the energy in the frequency range below the cut-off frequency of the first higher-order mode is concentrated in the axially symmetric component. ESA

N86-31854# Karlsruhe Univ. (West Germany). Sonderforschungsbereich 210.

TURBULENCE MODELING FOR INCOMPRESSIBLE FLOWS: A REPORT ON THE EUROMECH 180 COLLOQUIUM

W. Rodi Dec. 1985 53 p Colloquium held in Karlsruhe, West Germany, 4-6 Jul. 1984; sponsored by Deutsche Forschungsgemeinschaft, the State of Baden-Wuerttemberg, West Germany, A. S. Veritas Research, Daimler-Benz AG and Motoren-und Turbinen Union Muenchen GmbH

(KU-SFB-210/T/22; ESA-86-97832) Avail: NTIS HC A04/MF A01

Two-equation turbulence models and applications; higher-order models and implications for conventional closures; second-order closures and applications; low Reynolds number models and boundary layer calculations; and effects of buoyancy and rotation were discussed. ESA

N86-31855# Rome Univ. (Italy). Dipt. di Fisica.

INTEGRABLE SYSTEMS IN THE DESCRIPTION OF WAVES IN STRAITS AND CHANNELS OF VARIABLE WIDTH AND DEPTH [SISTEMI INTEGRABILI NELLA DESCRIZIONE DI ONDE IN STRETTI O CANALI DI PROFONDITA' E LARGHEZZA VARIABILI]

Decio Levi 19 Dec. 1985 8 p In ITALIAN

(Preprint-493; ESA-86-97926) Avail: NTIS HC A02/MF A01

A theoretical model to explain data about the initiation and propagation of solitary waves in presented. Starting with the Euler equation for frictionless incompressible homogeneous fluids, and using an approximation considering almost one dimensional long waves and shallow water, a partial differential nonlinear equation of the Kadomstev-Petviashivili type is obtained, characterized by variable coefficients and boundary conditions. Once the vorticity is specified, and for given contour conditions, the equation can be exactly integrated. ESA

N86-31856# Netherlands Energy Research Foundation, Petten.

FINITE ELEMENT, STREAM FUNCTION-VORTICITY SOLUTION OF SECONDARY FLOW IN THE CROSS-PLANE OF NONCIRCULAR CHANNELS

W. Slagter and H. Koning Dec. 1985 67 p

(ECN-175; B8665001; ESA-86-98065) Avail: NTIS HC A04/MF A01

A finite element method was applied to predict features of the fully developed turbulent flow in noncircular passages. The primary, axial flow, and turbulent kinetic energy distributions were predicted for fully developed turbulent flow conditions up to the wall. The secondary velocity is represented by the stream function-vorticity formulation and the no-slip boundary conditions are explicitly introduced in the nonlinear equations by a boundary vorticity formula. The Newton-Raphson method is applied to the stream function-vorticity equations and the resulting set of equations is solved simultaneously by the frontal solution technique. A one-equation eddy viscosity model of turbulence and an algebraic stress transport model were used to predict primary axial velocity, secondary velocities, and turbulent kinetic energy. The predictions obtained for a central subchannel of an equilateral triangular rod array with p/d = 1.3 are in reasonable agreement with experimental data. ESA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-31857*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PARAMETRIC STUDY OF BEAM REFRACTION PROBLEMS ACROSS LASER ANEMOMETER WINDOWS

Albert K. Owen Jun. 1986 33 p Presented at the Third International Symposim on Applications of Laser Anemometry to Fluid Mechanics, Lisbon, Portugal, 7-9 Jul. 1986; sponsored by the Instituto Superior Tecnico

(NASA-TM-87350; E-3064; NAS 1.15:87350; USAAVSCOM-TR-86-C-16) Avail: NTIS HC A03/MF A01 CSCL 14B

The experimenter is often required to view flows through a window with a different index of refraction than either the medium being observed or the medium that the laser anemometer is immersed in. The refraction that occurs at the window surfaces may lead to undesirable changes in probe volume position or beam crossing angle and can lead to partial or complete beam uncrossing. This report describes the results of a parametric study of this problem using a ray tracing technique to predict these changes. The windows studied were a flat plate and a simple cyclinder. For the flat-plate study: (1) surface thickness, (2) beam crossing angle, (3) bisecting line - surface normal angle, and (4) incoming beam plane surface orientation were varied. For the cylindrical window additional parameters were also varied: (1) probe volume immersion, (2) probe volume off-radial position, and (3) probe volume position out of the R-theta plane of the lens. A number of empirical correlations were deduced to aid the interested reader in determining the movement, uncrossing, and change in crossing angle for a particular situation. Author

N86-31858*# Morgan State Univ., Baltimore, Md.

A DENSITOMETRIC ANALYSIS OF IIaO FILM FLOWN ABOARD THE SPACE SHUTTLE TRANSPORTATION SYSTEM STS-3, STS-8, AND STS-7 Semiannual Report, Dec. 1986

Ernest C. Hammond, Jr., Kevin A. Peters, and Pamela F. Atkinson 1986 23 p

(Contract NsG-5074)

(NASA-CR-176864; NAS 1.26:176864) Avail: NTIS HC A02/MF A01 CSCL 14E

Three canisters of IIaO film were prepared along with packets of color film from the National Geographic Society, which were then placed on the Space Shuttle #3. The ultimate goal was to obtain reasonably accurate data concerning the background fogging effects on IIaO film as it relates to the film's total environmental experience. This includes: the ground based packing, and loading of the film from Goddard Space Flight Center to Cape Kennedy; the effects of the solar wind, humidity, and cosmic rays; the Van Allen Belt radiation exposure; various thermal effect; reentry and off-loading of the film during take off, and 8 day, 3 hour 15 minutes orbits. The total densitometric change caused by all of the above factors were examined. The results of these studies have implications for the utilization of IIaO spectroscopic film on the future shuttle and space lab missions. These responses to standard photonic energy sources will have immediate application for the uneven responses of the film photographing a star field in a terrestrial or extraterrestrial environment with associated digital imaging equipment. B.G.

N86-31859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED OPTICAL MEASURING SYSTEMS FOR MEASURING THE PROPERTIES OF FLUIDS AND STRUCTURES
Arthur J. Decker 1986 37 p Presented at the Symposium on Propulsion Instrumentation, Jiangyou, China, 6-10 Oct. 1986; sponsored by NASA and the Chinese Aeronautical Establishment
(NASA-TM-88829; E-3204; NAS 1.15:88829) Avail: NTIS HC A03/MF A01 CSCL 20F

Four advanced optical models are reviewed for the measurement of visualization of flow and structural properties. Double-exposure, diffuse-illumination, holographic interferometry can be used for three-dimensional flow visualization. When this method is combined with optical heterodyning, precise measurements of structural displacements or fluid density are possible. Time-average holography is well known as a method for displaying vibrational mode shapes, but it also can be used for flow visualization and flow measurements. Deflectometry is used to measure or visualize the deflection of light rays from collimation. Said deflection occurs because of refraction in a fluid or because of reflection from a tilted surface. The moire technique for deflectometry, when combined with optical heterodyning, permits very precise measurements of these quantities. The rainbow schlieren method of deflectometry allows varying deflection angles to be encoded with colors for visualization. Author

N86-31860# Department of the Air Force, Washington, D.C.
MULTIPLE THERMOCOUPLE TESTING DEVICE Patent
James R. Hildebrand and Kurt J. Sobanski, inventors (to Air Force) Issued 18 Feb. 1986 11 p Supersedes AD-D009951
(AD-D012276; US-Patent-4,571,689; US-Patent-Appl-SN-435515; US-Patent-Class-364-481) Avail: NTIS Avail: US Patent and Trademark Office CSCL 09/5

An automated multiple thermocouple testing device determines short and open circuits in a thermocouple system. The thermocouple system that has a plurality of temperature probes, each probe has a first thermocouple. The device applies a direct current voltage to the first thermocouple to cause heating in the second thermocouple and a second thermocouple and then reads the temperature response of the second thermocouple. The first thermocouples have a common lead and the second thermocouples are connected in two parallel groups. The temperature output of the second thermocouple is digitized and read by a computer. These readings are compared to criteria which determine if there is an open circuit. Before the open circuit test is applied, the device also determines which thermocouple probe has a possible short circuit. This device can automatically test for short and open circuits in a thermocouple system within a few minutes without the necessity of removing the probes from their installed position. This device was adapted to perform the above testing on a F100 fan turbine inlet temperature (FTIT) system. GRA

N86-31861# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
ANALYSIS OF HIGH POWER RF WINDOWS FOR GYROTRONS Final Report, Sep. 1982 - Sep. 1985
Anton G. Krycuk Jan. 1986 54 p
(Contract F30602-82-C-0161)
(AD-A167424; UTEC-85-080; RADC-TR-85-254) Avail: NTIS HC A04/MF A01 CSCL 09/5

The project was undertaken to simplify the multidisk dielectric window design process for gyrotrons. The response of many discrete combinations of high power radiofrequency window thicknesses is analyzed in an effort to locate the optimum configurations. This report presents a method of numerically optimizing the design procedure. The window region of the gyrotron is severely overmoded, so care must be taken that the window be able to pass the energy contained in the high power modes to avoid overheating or reflection. To this end, the first part of this paper deals with a numerical solution of Solimar's modified telegraphist equation, which allows for the mode content intercepting upon the window to be found. The actual window design optimization is accomplished through the use of an n dimensional simplex method, where n is the number of window elements. Criteria delineating the search region are presented as well as typical problems which could be encountered during the optimization process. Results are given for both the mode content and the optimization. Mode content was compared against results given by a comparable proven algorithm, while window parameters were checked against existing designs with good correlation. GRA

N86-31862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHINESE JOURNAL OF LASERS (SELECTED ARTICLES)
Fuxi Gan and Yinxia Zhang 22 Apr. 1986 54 p Transl. into ENGLISH from Zhong Guo Jiguang (China), v. 11, no. 8, 1984 p 449-463
(AD-A167846; FTD-ID(RS)T-0004-86) Avail: NTIS HC A04/MF A01 CSCL 20/5

A general review is made on the past and future of the research progress on laser crystals in China. Some proposals are offered in order to open up a new prospect for the development of laser crystals. Various methods for measuring different kinds of physical properties of laser glasses also have been investigated and the corresponding apparatus have been installed. Emphasis is laid on the inspection of optical quality of large size glass products, and a laser holographic interferometer for optical homogeneity measurement has been developed. This paper also reports some fundamental research results on laser glasses. By using laser glass spectroscopy, the special properties and structural state of rare earth ions in inorganic glasses were investigated before. The study of spectral and luminescent properties of Nd doped glasses was emphasized. Further detailed studies of the influence of the glass bases on spectral properties of Nd ion and the energy transfer process of Nd ions in glasses were made. GRA

N86-31863# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
RADIAL VELOCITY SPECTROMETERS. WHAT THEY MEASURE
Laurence G. Taff 24 Mar. 1986 24 p
(Contract F19628-85-C-0002)
(AD-A167986; TR-738; ESD-TR-85-304) Avail: NTIS HC A02/MF A01 CSCL 17/8

This report provides the theoretical analysis, within the framework of special relativity, for the information content of a radial velocity spectrometer. This device is an automated telescope photometer spectrometer combination. It measures the displacement between a Doppler shifted set of spectral lines and its at-rest version. Thus, it provides a measurement of radial velocity. Exactly what kinematical content is revealed by such a measurement within the solar system is brought out herein. The discussion is couched in terms of a satellite-based sensor observing another orbiting body. Both objects are presumed to orbit about the Earth. Sufficient generality is presented to treat any other case also. In the specific case of interest, both the topocentric distance and the topocentric radial velocity are present in the measured quality. GRA

N86-31864# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
DEVELOPMENT OF AN IMAGING FOURIER TRANSFORM SPECTROMETER Final Report, Oct. 1980 - Sep. 1985
Charles W. Pender, Jr. (Sverdrup Technology, Inc., Arnold Air Force Station, Tenn.) May 1986 93 p Prepared in cooperation with Sverdrup Technology
(AD-A168172; AEDC-TR-86-17) Avail: NTIS HC A05/MF A01 CSCL 14/2

This study established the feasibility of an Infrared Imaging Fourier Transform Spectrometer (IRIFTS), and the development of a working prototype is described herein. The IRIFTS is a measurement system that can simultaneously acquire spatial, spectral, and temporal IR radiance information. The theory of the components is presented, a more general half-angle obliquity limit is derived for the Fourier Transform Spectrometer (FTS), and the theoretical feasibility of the concept is shown. Commercially available components were acquired, interfaces were constructed,

and a one dimensional (spatial) imaging FTS system prototype was assembled. Results are presented for the operation of the system. GRA

N86-31865# Rochester Univ., N. Y. School of Medicine and Dentistry.
APPLICATION OF NEW TECHNOLOGIES TO RADIATION BIODOSIMETRY IN MAMMALIAN SYSTEMS Final Report, 3 Jan. - 31 Dec. 1984
Robert M. Sutherland, Edith M. Lord, and Peter C. Keng Feb. 1986 33 p
(Contract F33615-84-C-0603)
(AD-A168176; USAFSAM-TR-85-66) Avail: NTIS HC A03/MF A01 CSCL 06/18

Mononuclear cells from peripheral blood are presently the best candidates for a space radiation biodosimeter for man because they are easily obtained, and are among the most radiosensitive cells in the body. They are, however, members of a highly heterogeneous population of cell subtypes potentially differing in radiosensitivities. To study the cell subpopulation holding the greatest potential for use as a biodosimeter, the cell types must be uniquely identified, and/or seperated so that subtle effects on radiosensitive cells are not masked by non-effects on relatively radioresistant cells present in a mixed population. Flow cytometry and centrifugal elutriation are proving to be useful for identifying and separating individual subpopulations from heterogeneous mixtures of cells. Flow cytometry uses fluorescent antibodies to label and sort the cells of interest, while centrifugal elutriation utilizes counterbalanced centrifugal and fluid flow forces to separate cells by size. In combination with two analytical procedures (premature chromosome condensation (PCC) and alkaline elution), these two techniques have been applied to study radiation effects on mononuclear cells from mouse peripheral blood irradiated in vivo, and cell cycle phase specific repair of single-strand breaks in cellular deoxyribonucleic acid (DNA) of the Chinese hamster ovary (CHO) fibroblast cell line irradiated in vitro. GRA

N86-31866# Los Alamos National Lab., N. Mex.
WORKSHOP ON STANDARDS FOR PHOTONIC STREAK CAMERA CHARACTERIZATION
G. L. Stradling 1985 6 p Presented at the SPIE International Technical Symposium on Optical and Electro-Optical Engineers, San Diego, Calif. 18 Aug. 1985
(Contract W-7405-eng-36)
(DE86-002430; LA-UR-85-3834; CONF-850887-41) Avail: NTIS HC A02/MF A01

A summary paper proposing standardization of definitions and parameter measurements related to photonic streak cameras was generated at the 16th International Congress of High Speed Photography and Photonics at Strasborg, France (August 1984). An international committee appointed by the general Workshop on Picosecond Streak Cameras met and discussed the areas appropriate for standardization and proposed specific definitions, measurements and complementary parameter sets to be used in characterizing photonic streak cameras. These proposals were compiled into a summary paper by the committee co-chairmen, Noel Fleurot (CEA-Limeil) and Gary L. Stradling (Los Alamos National Laboratory), with the intent that it be distributed to interested streak camera users and manufacturers and that appropriate improvements and additions be solicited. DOE

N86-31867# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MULTICHANNEL AUTOMATIC DEVICE FOR MEASURING ULTRALOW TEMPERATURES
A. B. Neganov 1985 5 p In RUSSIAN
(DE86-701438; JINR-8-85-291) Avail: NTIS (US Sales Only) HC A02/MF A01

A 16-channel automatic device for carbonic termistor resistance measurements is described. It provides the measurement of 20 Ohm up to 200 kohm resistances in four automatically selected subranges at heat release in the termistor of 10(-12) 10(-15)W. The data from 6 thermometers are recorded onto self-recorder tape and put out on digital display. Resistance measurement accuracy is not worse than 0.5%. The device has remote control and parallel interfaces. DOE

N86-31868# Army Research and Development Command, Dover, N.J.
OPTICAL PROFILING INSTRUMENT FOR THE MEASUREMENT OF THE FIGURE AND FINISH OF OPTICAL QUALITY SURFACES
E. L. Church and P. Z. Takacs Sep. 1985 36 p Presented at the 3rd International Conference on the Properties and Metrology of Engineering Surfaces, Middlesborough, England, 10 Apr. 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contract DE-AC02-76CH-00016)
(DE86-009433; BNL-37880; CONF-8504226-1) Avail: NTIS HC A03/MF A01

This paper discusses the use of WYKO non-contracting optical profiling microscope for the measurement of the figure and finish of optical-quality surfaces. THe original instrument and our hardware and software modifications are described along with recent and current studies making use of this facility. DOE

N86-31869# Heimann G.m.b.H., Wiesbaden (West Germany).
SOLID STATE IMAGE SENSOR WITH AN AMORPHOUS PHOTOCONVERSION LAYER Final Report, Feb. 1984
Bernd Heimann, Ulrich Traupe, Heiner Herbst, and Karl Kempter Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 76 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-164; ISSN-0340-7608; ESA-86-97443) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

A solid state image sensor using an amorphous silicon layer (a-Si:H) on top of a 100x100 pixel readout matrix was developed. The sensor features a linear signal characteristic at low illumination levels and a nonlinear one at high illumination levels; it is thus capable of transferring a higher dynamic range. Blooming was suppressed to a value one fifth of that of monolithic MOS-sensors. The sensor is suitable for color television applications. The sensitivity is a little low compared to monolithic image sensors; the cause of the sensitivity decay and measures to improve the value are discussed. Based on results of sandwich-structure a-Si depositions on glass substrates and a-Si photolayers incorporated in vidicon tubes, the structure of the sensor image part was determined to be Al(a-Si:H)ITO. Test equipment was designed and installed to check sensor data. ESA

N86-31870# AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.
OPTOELECTRONIC CURRENT TRANSDUCER Final Report, May 1984
Klaus Hoffman Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 87 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-165; ISSN-0340-7608; ESA-86-97444) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

A current transducer which permits the measurement of high currents in high voltage substations by means of the Faraday effect in optical monomode fibers was developed. The measuring system has a large bandwidth and a linear signal-to-current characteristic up to high currents without saturation. High voltage insulation presents no serious problems. A V-grooved semiconductor laser is used as light source and is installed in a solid case which also houses the detection unit. The monomode fiber is placed in a teflon hose, loosely and sufficiently twisted to avoid birefringence. The fiber is coupled to the laser by gradient index lenses. Astigmatism is reduced by ellipsoidal shaping and etching of the fiber end to form a lens-like element. Part of the device was tested in the laboratory. With a 62- turn primary fiber coil,

the minimum detectable signal is 0.15 Amp-turns. It is shown that the magnetooptical transducer can be improved. Measurements in a high power bus and a comparison with simultaneous conventional current measurements are planned. ESA

N86-31871# Intermetall, Freiburg (West Germany). Halbleiterwerk der Deutsche ITT Industries GmbH.
DEVELOPMENT OF A DIGITAL SIGNAL PROCESSOR Final Report, Apr. 1985
Peter Anders, Klaus Herberle, Bernhard Schmid, Arnold Uhlenhoff, Manfred Ulrich, Martin Winterer, Edmund Zaehringer, Mandred Immendoerfer (Standard Elektrik Lorenz A.G., Stuttgart, West Germany), Siegbert Hentschke, Dieter Kopp et al Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 254 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-181; ISSN-0340-7608; ESA-86-97449) Avail: NTIS HC A12/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 42

A digital signal processor whose architecture was optimized for signal processing algorithms was developed. The processor has a multibus structure, distributed memories, and uses pipelined program execution. The basic arithmetic instruction is multiply and add, carried out within 2 instruction cycles of 100 msec each. Development tools such as cross-assembler, simulator (debugger), and in-circuit emulator are provided for the design of consumer applications. Due to its high computing speed and low power dissipation, the digital signal processor has a wide range of possible applications. ESA

N86-31872# Institut Franco-Allemand de Recherches, St. Louis (France).
INTERFEROMETRIC HOLOGRAPHIC CINEMATOGRAPHY [CINEHOLOGRAPHIE INTERFEROMETRIQUE]
H. Fagot 12 Jul. 1985 17 p In FRENCH Presented at HOLOPRO 85 Conference, Belfort, France, 21 Jun. 1985
(ISL-CO-219/85; ESA-86-97628) Avail: NTIS HC A02/MF A01

Double exposition holographic interferometry was employed to obtain a 35 mm scientific film. The deformations and deplacements of a loudspeaker were visualized at 20 to 70 Hz vibration frequencies. A 30 mJ YAG laser was used. The two successive pulses of each hologram are produced at 4 ms interval by the same laser beam. The 35 mm camera operates at 10 Hz. The device is limited to low frequency phenomena. The development of higher frequency systems is discussed with a view to nondestructive control of vibration in aircraft structures. ESA

N86-31873# Netherlands Energy Research Foundation, Petten.
A REMOTE CONTROLLED CALIBRATION DEVICE FOR DISPLACEMENT TRANSDUCERS
G. L. Tjoa and R. denBoef Nov. 1985 23 p
(ECN-173; B8577864; ESA-86-97732) Avail: NTIS HC A02/MF A01

A mechanical system to calibrate extensometer transducers at ambient temperature in a shielded facility for examining mechanical properties (especially creep) of irradiated materials is described. The system consists of a piezoelectric translator including a microprocessor-based controller in a calibration rig. Two transducers can be verified simultaneously. The equipment was integrated into a computer controlled data acquisition system to provide for the required data processing and analysis. The system functions satisfactorily, showing high resolution and accuracy, and is easy to operate remotely. ESA

N86-31874# Netherlands Energy Research Foundation, Petten.
INTERNATIONAL COMPARISON OF INTERPOLATION PROCEDURES FOR THE EFFICIENCY OF GERMANIUM GAMMA-RAY SPECTROMETERS (GAM83 EXERCISE)
Willem Zijp, Adelbertus N. Polle, and Henk J. Nolthenius Jan. 1986 83 p
(ECN-181; ICRM-S-13; B8661179; ESA-86-97737) Avail: NTIS HC A05/MF A01

Forty-one laboratories determined full energy peak efficiencies and activities of a gamma of ray spectrometer by their own procedures, starting from supplied peak-efficiency data. Four data sets for four different conditions of germanium detectors were distributed. The great variety of fitting functions combined with the calculated large standard deviation of the parameters (709) and the strong correlations which are observed, indicates that no single physical acceptable function can be recommended as a general purpose model for describing the efficiency curve of a semiconductor gamma ray spectrometer. ESA

N86-31875# Institut Franco-Allemand de Recherches, St. Louis (France).
COMPUTER ASSISTED MEASUREMENT TECHNIQUES IN LASER DOPPLER ANEMOMETRY (LDA). PART 1: DATA ACQUISITION. PART 2: DATA REDUCTION
H. J. Pfeifer 15 May 1985 50 p Presented at Von Karman Inst. for Fluid Dynamics Lectures Series on the Computer in Experimental Fluid Dynamics, Rhode Saint Genese, Belgium, 6-10 May 1985
(ISL-CO-210/85-Pt-1-Pt-2; ESA-86-97625-Pt-1-Pt-2) Avail: NTIS HC A03/MF A01

The role of computers as part of the instrumentation in laser Doppler anemometry is reviewed. It is shown that no useful configuration of such an anemometer can be set up without powerful computer assistance. Computer utilization in data acquisition with counter processors, transient recorders and photon correlators is examined. The optimum use of the anemometer requires also computerized control of various parts of the system, such as filter banks and traverse systems. ESA

N86-31876# Institut Franco-Allemand de Recherches, St. Louis (France).
USE OF AN ENDOSCOPE FOR OPTICAL FIBER HOLOGRAPHY
F. Albe, H. Fagot, and P. Smigielski 11 Oct. 1985 8 p Presented at Second International Technical Symposium on Optical and Electrooptical Science and Engineering and Instrument Display, Cannes, France, 2-6 Dec. 1985 Submitted for publication
(Contract DRET-83-1160)
(ISL-CO-224/85; ESA-86-97629) Avail: NTIS HC A02/MF A01

The problems of recording holograms through optical fibers are discussed. Tests made using a holographic arrangement are described. The experimental set up includes a continuous wave or pulsed laser, one or several multimode fibers, an imaging fiber bundle for the object beam and a monomode fiber for the reference beam. Various holograms of a small object were recorded and reconstructed images are shown. ESA

N86-31877# Institut Franco-Allemand de Recherches, St. Louis (France).
A SINGLE SIDEBAND SUPPRESSED CARRIER (SSBSC) INTERFEROMETER FOR THE MEASUREMENT OF DIELECTRIC PROPERTIES OF LASER HEATED MATERIALS
J. Pierson 22 Oct. 1985 10 p Presented at 15th European Microwave 85 Conference, Paris, France, 9-13 Sep. 1985
(ISL-CO-228/85; ESA-86-97630) Avail: NTIS HC A02/MF A01

A method to measure the dielectric properties of ceramic materials at high temperatures is described. The device is a Ka band microwave bridge which uses a single sideband suppressed carrier signal as reference. A carrier modulated by ferrite modulator around its maximum insertion loss gives a double sideband suppressed carrier signal. By addition of two such signals the SSBSC is obtained. The high rejection of the carrier and the other sideband gives results with the required accuracy. By this method the temperature range of dielectric measurements is extended to 2500 K. ESA

N86-31878# Societe Europeenne de Propulsion, Puteaux (France). Space Dept.
GAS FLOWMETER FOR A SPACE CRYOSTAT Final Report [DEBITMETRE A GAZ POUR CRYOSTAT SPATIAL]
R. Petit Paris ESA 28 Jun. 1985 142 p In FRENCH; ENGLISH summary

(Contract ESTEC-5486/83)
(SEP-TS/SE/BT/10.269/85; ESA-CR(P)-2189; ESA-86-97786) Avail: NTIS HC A07/MF A01

A flowmeter for hydrogen and helium fluid loops was designed for the Infrared Space Observatory. The design is based on a commercial thermal mass analyzer (temperature, pressure, flow). Main modifications concern the electronic parts. A test program including functional tests down to 100 K, and vibration tests at qualification level were carried out. The tests fulfill all the specifications. ESA

N86-31879# Rome Univ. (Italy). Dipt. di Fisica.
EVOLUTION OF NUCLEAR EMULSION TECHNIQUES IN THE FIRST HALF OF THIS CENTURY [EVOLUZIONE TECHNICA DELLE EMULSIONI NUCLEARI NELLA PRIMA META'DEL 1900(I)]
M. Grilli 22 Jan. 1986 51 p In ITALIAN
(Nota-Interna-860; ESA-86-97894) Avail: NTIS HC A04/MF A01

The history of the discovery and developing of photographic techniques to detect and record elementary particle signatures is reviewed. Results of Kinoshita on alpha particles interaction with photographic emulsions, Mayer and Sahmi scattering chamber, thick emulsion for neutron detection, chemical sensitivation of neutron detecting emulsions, proton sensitive plates, and modern nuclear application photographic plates are discussed. ESA

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-31880# Tacan Aerospace Corp., Carlsbad, Calif.
NONLINEAR OPTICAL INTERACTIONS IN SEMICONDUCTORS Final Report, 10 Aug. 1983 - 31 Dec. 1985
Michael M. Salour 10 Dec. 1985 16 p
(Contract F49620-83-C-0147)
(AD-A166182; AFOSR-86-0089TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The optical pumping technique in GaAs has led to the development of a novel and highly sensitive optical temperature sensor. Completed is the experiment on two photon optical pumping in ZnO. An external cavity semiconductor laser involving ZnO as a gain medium was demonstrated under two-photon excitation. This laser should have a major impact on the development of tunable blue-green radiation for submarine communication. Completed is a paper on heat buildup in semiconductor platelets. New lasers are used to explore elementary excitation in optical thin film layers of semiconductors. This has led to the first demonstration of the feasibility of room temperature operation of a tunable coherent source involving multiple quantum well material. Completed is the construction of a simple remote (non-contact) temperature sensor to directly measure heat buildup in semiconductor materials as a result of high power optical laser excitation. Finally, an experiment involving optical frequency mixing to probe electrodynamics in the GaAlAs multiple quantumwell and superlattice structures, utilizing two recently constructed tunabel laser systems,has been successful. Attempts were focused on observing a number of new optical effects including nonlinear absorption and tranamission phenomena, enhanced spontaneous and stimulated light scattering processes, etc. The construction of an external cavity semiconductor HgCdTe has been successful. GRA

N86-31881# Lawrence Livermore National Lab., Calif.
NOVA PERFORMANCE AT ULTRA HIGH FLUENCE LEVELS
J. T. Hunt 1986 9 p Presented at the Los Angeles Symposium and Exhibition on Optical and Electro-Optical Engineering, Los Angeles, Calif., 19 Jan. 1986
(Contract W-7405-eng-48)
(DE86-006724; UCRL-93886; CONF-860117-3) Avail: NTIS HC A02/MF A01

Nova is a ten beam high power Nd:glass laser used for inertial confinement fusion research. It was operated in the high power high energy regime following the completion of construction in December 1984. During this period several interesting nonlinear optical phenomena were observed. These phenomena are discussed in the text. DOE

N86-31882# Lawrence Livermore National Lab., Calif.
CURRENT STATUS IN DEVELOPMENT OF AVERAGING LASER STRAINOMETER AND TESTING SYSTEM
R. L. Brady 19 Jun. 1986 14 p Presented at the 41st Meeting of the IMOG Subgroup on Environmental Testing, Miamisburg, Ohio, 18 Jun. 1985
(Contract W-7405-eng-48)
(DE86-006727; UCRL-92746; CONF-8506117-4) Avail: NTIS HC A02/MF A01

The advent of a new method of sweeping a laser beam to accurately measure a shadow image offers unique applications to mechanical testing. A new commercial low power continuous wave laser system designed for metrological applications is being applied to the testing of a delicate, brittle, notch sensitive, hygroscopic material requiring dry box enclosure. An integrated testing system is being developed to provide remote strain sensing of minimum, maximum, and average surface strains on the cylindrical portion of a compression specimen. The system additionally provides the means to compensate for bending strains observed in pretest alignment evaulation. The results of the development of the testing fixture to date are discussed. DOE

N86-31883# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
EXPERIMENTAL INVESTIGATIONS OF THE ROLE OF LASER FIELD FLUCTUATIONS IN NON-LINEAR OPTICAL ABSORPTION PROCESSES
S. J. Smith 1985 11 p Presented at the 6th International Conference on Coherent Optics, Ustron, Poland, 19 Sep. 1985
(Contract DE-AC02-80ER-10736)
(DE86-006919; CONF-8509245-1) Avail: NTIS HC A02/MF A01

In the experimental program described, a well-stabilized single mode laser beam was deliberately broadened by introducing fluctuations to the laser frequency in order to synthesize laser power spectra for which the fluctuations are well-characterized to all orders in a statistical sense. This technique produces single mode laser fields which have nearly Lorentzian power spectra at one limit, essentially Gaussian power spectra at the other limit, and which may be varied continuously between these two limits. DOE

N86-31884# Lawrence Livermore National Lab., Calif.
COATINGS FOR HIGH ENERGY APPLICATIONS. THE NOVA LASER
G. R. Wirtenson 1986 35 p Presented at the Los Angeles Symposium and Exhibition on Optical and Electro-optical Engineering, Los Angeles, Calif., 19 Jan. 1986
(Contract W-7405-eng-48)
(DE86-009407; UCRL-93950; CONF-860117-8) Avail: NTIS HC A03/MF A01

The combined requirements of energy density, multiple wavelength, and aperture make the coatings for the Nova Inertial Confinement Fusion (ICF) laser unique. This ten beam neodymium glass laser system, built at the Lawrence Livermore National Laboratory (LLNL), has over a thousand major optical components; some larger than one meter in diameter and weighing 380 Kg. The laser operates at 1054 nm and can be frequency doubled to 527 nm or tripled to 351 nm by means of full aperture potassium dihydrogen phosphate (KDP) crystal arrays. The 1.0 nsec fluence varies along the laser chain, sometimes reaching values as high as 16 J/cm(2) at the input lens to one of the spatial filters. The design specifications of this massive optical system were changed several times as the state-of-the-art advanced. Each change required redesign of the optical coatings even as vendors were preparing for production runs. Frequency conversion to include shorter wavelengths mandated the first major coating redesign and was followed almost immediately by a second redesign to reduce solarization effects in borosilicate crown glass. The conventional thermal evaporation process although successful

for the deposition of mirror coatings, was not able to produce antireflection coatings able to survive the locally high chain fluences. As a consequence it became necessary to develop another technique. Solution produced coatings were developed having transmissions exceeding 99% per part and damage threshold values equal to the bare substrate. The unique requirement of the Nova laser necessitated special deposition and metrology equipment. These programmatic developments will be reviewed in the context of the cooperative working relationship developed between LLNL and its vendors. It was this excellent relationship which has enabled LLNL to obtain these highly specialized coatings for the Nova laser. DOE

N86-31885# Lawrence Livermore National Lab., Calif.
TIME AND SPACE RESOLVED SPECTROSCOPY OF X-RAY LASER EXPERIMENTS
N. M. Ceglio 1 Apr. 1986 23 p Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif., 28 Oct. 1985
(Contract W-7405-eng-48)
(DE86-009403; UCRL-94257; CONF-851053-12) Avail: NTIS HC A02/MF A01

We report experimental data from one of the first of this new generation of instruments designed specifically for laboratory X-ray laser diagnosis. Representative TGSS-EM data are presented from three different X-ray laser inversion schemes: collisional excitation of neon-like selenium (lambda approx. = 206, 209A); resonant photoexcitation of hydrogen-like fluorine (lambda = 81A); and recombination of hydrogen-like magnesium (lambda approx. = 130A). The data illustrate the measurement capabilities of the TGSS-EM and provide insight to the dynamics and emission characteristics of this new class of laser produced plasmas. DOE

N86-31886# Technische Hogeschool, Eindhoven (Netherlands). Vakgroep Telecommunicatie EC.
COMPETITION NOISE IN AN OPTICAL DIVIDER [KOMPETITIERUIS BIJ EEN OPTISCHE VERDELER]
G. J. A. M. vanLaarhoven May 1984 86 p In DUTCH
(ESA-86-97538) Avail: NTIS HC A05/MF A01

A model to determine the impact of competition noise on an optical communication system was set up. An optical divider based on the spatial wave front division principle and consisting of five fibers located in the radiation field of a laser diode without the use of optical devices was developed. Random fluctuations of the power of the laser causes competition noise. The theory was verified using random error measurements on the system. It is concluded that competition noise in an optical communication system can be neglected; the divider is recommended. ESA

N86-31887# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kreiselgeraete und Traegheitsnavigation.
INVESTIGATIONS OF LASER MIRRORS WITH DIFFERENT DESIGN
Rolf Gauert and Helmut Rosteck Dec. 1985 42 p In GERMAN; ENGLISH summary
(DFVLR-FB-85-65; ISSN-0171-1342; ESA-86-97584) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 17

Laser mirror reflectivity and integral backscattering were investigated. Mirrors were industrially fabricated, or were developed at DFVLR and have ZnS/MgF2 or Ag/ZnS/MgF2 interference coatings. The experimental mirror-coating machine was modified to get reproducible mirrors. The substrate holder was reconstructed so that privileged directions in the layer combination are suppressed. The measurement of the transmissibility during the coating process was carried out at an angle of incidence of 30 deg with a built-in deflection device. An IR heating device mounted into the machine enabled temperature of the substrates and the substrate holder to rise to 130 C. The effects limiting the mirror parameters, such as substrate temperature, impurities on the substrate surfaces, and evaporation speed, are discussed. The measurements show that substrate heating of ZnS/MF2 coatings provide hard and stable layers; the use of Ag/ZnS/MgF2 layer combinations increases the reflectivity by 0.1%. ESA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-31888 Societe Europeenne de Propulsion, Vernon (France).
STUDY OF TEST BENCH DANGERS IN VULCAN ENGINE TURBOPUMP TESTS. (A COMPONENT OF ARIANE 5 LAUNCHER) [ETUDE DES DANGERS DU BANC D'ESSAI DES TURBOPOMPES DU MOTEUR VULCAIN (DESTINE AU FUTUR LANCEUR EUROPEEN ARIANE 5)]
Herve Montalva, Olivier Creignou, and Guy Corteel 1986 30 p In FRENCH Presented at 4th Seminaire Europeen pour la Securite des Systemes, Deauville, France, 4-6 Jun. 1986
(ESA-86-97632) Avail: NTIS HC A03

The method employed for risk analysis and safety goals verification when designing a test bench for cryogenic turbopumps is discussed. During the tests, the oxygen is transfered to another tank while the hydrogen is burned in a specially designed water pond. The explosion risk is analyzed as a function of the mass of fuel involved, the instantaneous overpressure, thermal effects, and debris projection. The accident probability is estimated at 1 in 5000, for 100 tests in 1 yr. ESA

N86-31889*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE FATIGUE AND FAILURE CHARACTERISTICS OF HOT FORGED POWDER METAL AISI 4620, AISI 4640, AND MACHINED AISI 4340 STEEL SPUR GEARS
Dennis P. Townsend 1986 34 p Presented at the Annual Meeting of the American Society of Lubrication Engineers, Toronto, Ontario, 12-15 May 1986
(NASA-TM-87330; E-3024; NAS 1.15:87330) Avail: NTIS HC A03/MF A01 CSCL 13I

Spur gear surface fatigue endurance tests were conducted to investigate hot forged powder metal AISI 4620 and 4640 steel for use as a gear material, to determine endurance characteristics and to compare the results with machined AISI 4340 and 9310 steel gear materials. The as-forged and unground SISI 4620 gear exhibited a 10 percent fatigue life that was approximately one-fourth of that for AISI 9310 and less than one-half that for the AISI 4340 gears. The forged and finish ground AISI 4620 gears exhibited a 10 percent life, approximately 70 percent that of AISI 9310 and slightly better than that of AISI 4340. The AISI 4640 hot forged gears had less fracture toughness and slightly less fatigue life than the AISI 4620 test gears. Author

N86-31890*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIQUID HELIUM PUMPS FOR IN-ORBIT TRANSFER
Peter Kittel Apr. 1986 36 p
(NASA-TM-88239; A-86201; NAS 1.15:88239) Avail: NTIS HC A03/MF A01 CSCL 13K

Both mechanical and fountain-effect pumps are being considered for use in the in-orbit resupply of superfluid helium to a number of scientific instrument systems. This paper presents a review of the operating characteristics of these pumps. Particular emphasis will be given to the different methods of evaluating the efficiency of these pumps and their effectiveness in a transfer system. Author

N86-31891# Department of the Navy, Washington, D. C.
MECHANICAL RELOCKER FOR LOCKING BOLTS Patent
Teddy L. Pickett and Henry L. Self, inventors (to Navy) Issued 7 Jan. 1986 6 p Supersedes AD-D010900
(AD-D012209; US-Patent-4,562,706; US-Patent-Appl-SN-577100; US-Patent-Class-70-1.5) Avail: US Patent and Trademark Office CSCL 13/5

This patent discloses a torsion spring which longitudinally

rotates a locking bolt when the bolt actuating linkages is severed. A woodruff key or the like is upstanding from a surface of the bolt. When the linkage is undamaged, the key slides with the bolt through a slot on the lock frame. When the bolt is rotated by the spring, it is locked in the rotated position by a locking pawl. In the rotated position, the key is out of registry with the slot and the bolt cannot be withdrawn from its extended, locking position. A second embodiment replaces the key with a recess in the bolt into which a locking pawl engages to prevent movement of the locking bolt. GRA

N86-31892# Department of the Air Force, Washington, D.C.
IMPROVED ROBOTIC KITTING STATION Patent Application
Howard A. Reuter, inventor (to Air Force) Filed 15 Jan. 1986 23 p
(AD-D012238; US-Patent-Appl-SN-819185) Avail: NTIS HC A02/MF A01 CSCL 15/5

The assembly of electrical components into kits is accomplished by: a computer controlled robot; rotary rack carousel; a work station; an elevator; and a system controller. The carousel houses a systematically stored supply of electrical components in trays. The elevator has a rotating turntable with two oppositely oriented motor driven tray inserting and extracting grippers which supply the trays to the work station so that the robot can assemble the kits. The work station has two tray receiving tables which are alternately shuttled side-to-side to supply the kitting robot with trays of components from the carousel via the elevator. In operation, the robot arm picks parts from tray 1 with the dual indexing table in a first predetermined position. During this time empty tray 2 is returned to the carousel or storage. When the turntable rotates, tray 3 is slid in position on the empty indexing table. After tray 1 is emptied the tables shuttle sideward and tray 1 is returned to the elevator turntable while tray 3 is emptied. The cycle is then repeated. GRA

N86-31893# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
IMPROVEMENT OF THE CORROSION RESISTANCE OF TURBINE ENGINE BEARINGS Final Report, Aug. 1981 - Aug. 1985
J. H. Mohn, H. M. Hodgens, II, H. E. Munson, and W. E. Poole Apr. 1986 207 p
(Contract F33615-81-C-2023)
(AD-A167355; PWA/GPD-FR-18566; AFWAL-TR-85-2097) Avail: NTIS HC A10/MF A01 CSCL 11/6

Improved bearing corrosion resistance can be achieved with either the use of a new corrosion resistant alloy, or by surface treating, or coating state-of-the-art M50 with a protective covering. This two-phase program investigated all three methods; alloys, coatings, and surface treatments. Appropriate bearing materials, surface treatments, and coatings were identified. Screening tests were performed on the most promising candidates. Candidates with potential for improving bearing corrosion resistance included corrosion resistant alloys such as CRB7 (AMS5900), and BG42 (AMS5749), coatings such as the proprietary chrome plating process called Armoloy, and surface treatments such as nickel sputter-coated M50. This program was aimed at developing an alternate material, fabrication technique, or material treatment of turbine engine mainshaft bearings with improved corrosion resistance compared to state-of-the-art VIM-VAR-M50. During Phase I, five corrosion-resistance bearing candidates (Armoloy-coated M50, nickel sputter-coated M50, wrought CRB7, RSR565, and MRC2001) were identified as the most promising. These were subjected to rolling contact fatigue, corrosion, hot hardness, and wear screening tests. GRA

N86-31894# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A CLOSED-FORM SOLUTION FOR INVERSE KINEMATICS OF ROBOT MANIPULATOR WITH REDUNDANCY
Pyung H. Chang 31 Mar. 1986 27 p
(Contract N00014-85-K-0124)
(AD-A167850; AI-M-854) Avail: NTIS HC A03/MF A01 CSCL 13/9

A closed-form equation for inverse kinematics of robot manipulators with redundancy is derived, using the Lagrangian multiplier method. The proposed equation is proved to provide the exact equilibrium state of the resolved motion method, and is shown to be a general expression that yields the extended Jacobian method. The repeatability problem in the resolved motion method does not exist in the proposed equation. The equation is demonstrated to give more accurate trajectories than the resolved motion method. Author (GRA)

N86-31895# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
REDUNDANCY RESOLUTION OF MANIPULATORS THROUGH TORQUE OPTIMIZATION
John M. Hollerbach and Ki C. Suh Jan. 1986 18 p
(Contracts F33615-83-C-5115; N00014-77-C-0389)
(AD-A167851; AI-M-882) Avail: NTIS HC A02/MF A01 CSCL 13/9

Methods for resolving kinematic redundancies of manipulators by the effect on joint torque are examined. When the generalized inverse is formulated in terms of accelerations and incorporated into the dynamics, the effect of redundancy resolution on joint torque can be directly reflected. One method chooses the joint acceleration null-space vector to minimize joint torque in a least squares sense; when the least squares is weighted by allowable torque range, the joint torques tend to be kept within their limits. Contrasting methods employing only the pseudoinverse with and without weighting by the inertia matrix are presented. The results show an unexpected stability problem during long trajectories for the null-space methods and for the inertia-weighted pseudoinverse method, but rarely for the unweighted pseudoinverse method. Evidently a whiplash action develops over time that thrusts the endpoint off the intended path, and extremely high torques are required to overcome these natural movement dynamics. Author (GRA)

N86-31896# Department of the Air Force, Washington, D.C.
SAFE-ARM EXPLOSIVE TRANSFER MECHANISM Patent Application
Jensen, inventor (to Air Force) Filed 25 Feb. 1986 24 p
(AD-D012333; US-Patent-Appl-SN-833640) Avail: NTIS HC A02/MF A01 CSCL 19/1

A safe-arm mechanism for an air-delivered explosive device uses a slider containing explosive leads as the means of interrupting the explosive train. The slider is locked in the safe position such that the explosive leads are out-of-line with respect to the detonator. The slider is attached directly to the main parachute such that when two locks are removed the parachute deployment forces can overcome a shear pin lock and move the slider to an in-line or armed position where it is positively retained. In this position, initiation of the detonator will allow the explosive output of the detonator to be transferred to its associated explosive device and provide a dual point radial initiation of its booster charge. GRA

N86-31897# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
AUTOMATED VALVE EXPERTISE CAPTURE
D. L. Crandall 1985 6 p Presented at the Applications of Artificial Intelligence to Engineering Problems, Southampton, Engl., 15 Apr. 1985
(Contract DE-AC07-76ID-01570)
(DE86-004127; EGG-M-26885; CONF-8504204-1) Avail: NTIS HC A02/MF A01

Many experimental systems designed for energy research and development require the control of fluid flows. Selecting the appropriate valves for such systems is complicated not only by the uniqueness of the systems designed, but also by the availability of a variety of valves from a multitude of valve manufacturers. Individuals in large mechanical engineering organizations that design these experimental systems require comprehensive expert knowledge of valve selection but possess only limited portions of this experience based knowledge. Even though these organizations

have the expertise among their engineers, it is not consistently available to the right individual at the time of design. Expert systems (programs that solve problems by logical inference based on a store of knowledge) may eventually improve valve selection in mechanical design firms, but only if the problem of extracting and accumulating the expertise in the organization can be solved. This paper describes a computerized prototype titled VALVEFIND designed to accumulate specialized expertise in valve selection. DOE

N86-31898# SKF Industries, Inc., King of Prussia, Pa.
MECHANICAL INTERACTIONS OF ROUGH SURFACES Quarterly Progress Report, 31 Dec. 1985 - 31 Mar. 1986
J. T. McCool Apr. 1986 9 p
(Contract DE-AC02-84ER-13163)
(DE86-009161; DOE/ER-13163/10) Avail: NTIS HC A02/MF A01

An approach is described for estimating the shape of a roughness profile spectrum based on two parameters normally output by a stylus profile device. The validity of the approach is assessed for twelve distinct surfaces. An experimental approach to studying microfracture in ceramics is described. DOE

N86-31899# Sandia National Labs., Albuquerque, N. Mex.
CALORIMETRY OF THE ARC WELDING PROCESS
P. W. Fuerschbach and G. A. Knorovsky 1986 5 p Presented at the 2nd General Meeting on Calibration of Welding Systems, Livermore, Calif., 26 Feb. 1986
(Contract DE-AC04-76DP-00789)
(DE86-009280; SAND-86-0817C; CONF-860283-1) Avail: NTIS HC A02/MF A01

Minimizing the total heat input in arc welding is not usually a critical consideration when the size of the fusion zone and the weldment are very large. At SNLA, however, most welding can usually be described as microwelding. The depth of penetration is typically only 0.8 mm and hermeticity rather than mechanical strength is the primary joining requirement. For these type welds, minimizing heat input becomes a major process requirement since distortion of small components and damage to heat sensitive parts may result from large increases in the bulk temperature. In conclusion, we have found calorimetry to be a useful technique to determine the effect of arc welding process variables on heat input and melting efficiency and also to better select the required welding process for our weld geometries. DOE

N86-31900# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
FINITE-ELEMENT MODELING OF PINCH WELDS
K. E. Kain Mar. 1986 30 p
(Contract DE-AC09-76SR-00001)
(DE86-009573; DP-1715) Avail: NTIS HC A03/MF A01

Finite-element modeling was performed on pinch welds used to seal deuterium-tritium reservoirs at SRP. The analysis examined two of the possible failure mechanisms in these welds - service stresses and hydrogen/helium embrittlement. Both confined and unconfined weld geometries were considered. Service stresses due to the internal pressure of the deuterium-tritium gas mixture were modeled. Stress concentrations arising from an elastic material were examined along with those resulting from plastically deforming alloys. In addition, the analysis included deuterium and tritium diffusion along with radioactive decay of tritium to helium. Results show that the presence of embrittling species, in combination with large stress concentrations, would cause fracture if it occurred, to initiate preferentially in the corner regions of the tube. Comparisons of pinch weld geometries suggest that controlling weld contour will have minimal effect on resistance to crack growth. DOE

N86-31901# Sandia National Labs., Albuquerque, N. Mex.
SENSOR-DRIVEN, FAULT-TOLERANT CONTROL OF A MAINTENANCE ROBOT
M. M. Moya and W. M. Davidson 1986 23 p Presented at the IEEE International Conference on Robotics and Automation, San Francisco, Calif., 14 Apr. 1986
(Contract DE-AC04-76DP-00789)
(DE86-002118; SAND-85-2152C; CONF-860434-3) Avail: NTIS HC A02/MF A01

A robot system has been designed which will perform routine maintenance tasks on the Sandia Pulsed Reactor (SPR). The use of this Remote Maintenance Robot (RMR) is expected to significantly reduce the occupational radiation exposure of the reactor operators. Reactor safety was a key issue in the design of the robot maintenance system. Using sensors to detect error conditions and intelligent control to recover from the errors, the RMR is capable of responding to error conditions without creating a hazard. This paper describes the design features and implementation methods used to create sensor-driven, fault-tolerant control of the RMR. Features which make the system more tolerant to error conditions include the following: mechanical tolerances, continuous monitoring of force sensors, monitoring of verification switches, index point referencing, spiral searching with force feedback, and operator supervision. The paper also describes the mechanisms for error recovery. Error recovery is not automatic; it does rely on operator assistance. However, a key feature of the error recovery procedure is that the operator is allowed to reenter the programmed operation after the error has been corrected. The recovery procedure guarantees that the moving components of the system will not collide with the reactor during recovery. DOE

N86-31902# Lawrence Livermore National Lab., Calif.
VIBRATION DAMPING IN EXTERNALLY PRESSURIZED GAS BEARINGS
J. W. Roblee and C. D. Mote, Jr. Jun. 1986 7 p Presented at the International Conference on Vibration Problems in Engineering, Xian, China, 17 Jun. 1986 Prepared in cooperation with California Univ., Berkeley
(Contract W-7405-eng-48)
(DE86-003470; UCRL-93600; CONF-860651-1) Avail: NTIS HC A02/MF A01

The damping mechanisms in externally-pressurized gas bearings are investigated. A single-pole, single-zero transfer function is used to describe the dynamic stiffness of these bearings. The benefits of tuning their frequency-dependent damping are discussed and demonstrated experimentally. A type of auxiliary compensation is also shown to alter the dynamic stiffness of these bearings. DOE

N86-31903# Oak Ridge National Lab., Tenn.
STIRLING MACHINES: ADIABATIC TO ISOTHERMAL
C. D. West 1986 19 p Presented at the 3rd International Stirling Engine Conference, Rome, Italy, 1 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-005407; CONF-860676-1) Avail: NTIS HC A02/MF A01

In most real Stirling engines the gas behavior in the cylinder is almost adiabatic, in contrast to the ideal Stirling engine in which all processes are isothermal. The combination of nearly adiabatic cylinders and nearly isothermal heat exchangers found in most Stirling engines leads to irreversibilities and loss of efficiency. Still worse, in many cases, is the performance of cylinders with a finite heat transfer intermediate between a near-adiabatic and near-isothermal behavior. Because of this behavior and because of the low thermal diffusivity of high-pressure gases, there is little hope of sufficiently enhancing the heat transfer within the cylinder of a conventional Stirling engine to increase the efficiency - in most cases, a decrease is more likely to result. DOE

N86-31904# Helsinki Univ. Technology, Otaniemi (Finland). Internal Combustion Engine Lab.
ALCOHOL AS A FUEL IN A HIGH SPEED DIESEL ENGINE WITH DOUBLE INJECTION SYSTEM
J. Laurikko and J. Pitkaenen 1985 133 p In FINNISH
(DE86-751653; TKK-KO/PM-47) Avail: NTIS (US Sales Only) HC A07/MF A01

This report describes the results of tests carried out on a diesel engine equipped with two separate fuel injection systems and using alcohol as the main fuel. There is the possibility of

using pure alcohol as the main fuel in a diesel engine equipped with two fuel injection systems where ordinary diesel oil is used as ignition fuel. The advantages of this method are the large proportion of alcohol in the total amount of fuel and the possibility of using pure alcohol without the expensive ignition improving additive. The drawback is the high cost due to the complicated construction of the system, which is partly compensated by the cheaper fuel. The operation of a diesel engine with double injection systems is studied and the main parameters that control the combustion are compared to the data from similar tests given in the literature. The test results showed that from the parameters controlling the combustion the type of the auxiliary nozzle (i.e., the direction of the ignition fuel spray) had the strongest effect on engine performance. The B-type nozzle with fuel spray directed across the swirl in the combustion chamber gave better performance than the A-type, where ignition fuel was injected to the direction of the swirl. The B-type nozzle gave also better distribution and mixing of the ignition fuel, therefore the ignition lag of the main fuel was shorter and the brake thermal efficiency slightly better than with the A-type nozzle. DOE

N86-31905# Oak Ridge Gaseous Diffusion Plant, Tenn.
MAGNETIC BEARINGS: AN ADAPTIVE SOLUTION TO MOTION-CONTROL PROBLEMS
M. B. Scudiere and G. T. Gillies Mar. 1986 33 p
(Contract DE-AC05-84OT-21400)
(DE86-010615; K/TS-11780) Avail: NTIS HC A03/MF A01

High-precision rotating machinery often employs sophisticated motion-control systems. Typical of such systems are magnetic bearings. In this paper, the operational principles of feedback systems for magnetically suspended rotors are explored, with special emphasis on the rotor position sensors, servo circuits, and sources of magnetomotive force. Several applications for these systems are identified, and some important design characteristics in magnetic bearing technology are reviewed. The role played by Martin Marietta Energy Systems, Inc., and the University of Virginia in research and development of new suspension/bearing technologies is discussed, and their most recent contributions to this field are presented. DOE

N86-31906# GA Technologies, Inc., San Diego, Calif.
THERMAL HISTORY OF HT-9 WELDMENT HEAT-AFFECTED ZONES DURING WELDING
J. R. Foulds Apr. 1986 22 p Presented at the 2nd International Conference on Fusion Reactor Materials (ICFRM-2), Chicago, Ill., 13 Apr. 1986
(Contract DE-AC03-84ER-53158)
(DE86-010684; GA-A-18430; CONF-860421-48) Avail: NTIS HC A02/MF A01

HT-9, a commercial 12Cr-1Mo ferritic steel, is a candidate structural material for fusion reactor first walls. The microstructure in weldments of this material has been observed to vary over short distances as a function of the varying thermal history during welding. An example is the observation of several heat-affected zones over less than a 2.5 mm (0.1 in.) distance from the weld/base metal interface. The mechanical behavior response of local weldment microstructures can be characterized by simulation of the structure over larger usable volumes of material. This requires precise knowledge of the local thermal history during welding. An empirical equation for describing the thermal history of HT-9 weldment heat-affected zones during gas tungsten-arc welding is presented in this paper. Both peak temperatures and cool-down cycles, are predictable at any location in the base metal heat-affected zone for welding of plate under heat flow conditions similar to those anticipated for first wall component fabrication, i.e., two-dimensional heat flow. Power input and preheat effects are included in the equation. DOE

N86-31907# Argonne National Lab., Ill.
LEAKAGE FLOW-INDUCED VIBRATIONS FOR VARIATIONS OF A TUBE-IN-TUBE SLIP JOINT
T. M. Mulcahy Jan. 1986 39 p
(Contract W-31-109-eng-38)
(DE86-010765; ANL-86-11) Avail: NTIS HC A03/MF A01

Variations in the design of a specific slip joint separating two cantilevered, telescoping tubes conveying water were studied to determine their effect upon the leakage flow-induced vibration self-excitation mechanism known to exist for the original slip joint geometry. The important parameters controlling the self-excitation mechanism were identified, which, along with previous results, allowed the determination of a comprehensive set of design rules to avoid unstable vibrations. This was possible even though a new self-excitation mechanism was found when the engagement of the two tubes was small. DOE

N86-31908# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna.
DETERMINATION OF THE WEAR OF THERMOPLASTIC JOURNAL BEARINGS IN THE INITIAL STRAIN
Erich Frevert, Friedrich Franek, Robert Piringer, and Andreas Suschnig Jan. 1986 37 p In GERMAN; ENGLISH summary Presented at Seminar on Elektromechanische Konstruktionen, Vienna, Austria
(OEFZS-4345; IA-146/86; ESA-86-97247) Avail: NTIS HC A03/MF A01

The measurement of the wear of thermoplastic journal bearings using the radionuclide technique was investigated. The activation of the bearings can lead to changes in the molecular structure if it lasts too long. The wear of six activated bearings of one type was obtained in a fixed sequence and for given peripheries of the shaft. The amount of wear was calculated by comparing the radiation intensity of the wear probes with that of a standard specimen. The detection limit is 2 microg. In spite of the deviations of the single values caused by unequal loads on axis, the mean values show an indication of a bedding-in process up to 4000 m operating length followed by relatively constant wear. The simultaneous activation analysis of the probes shows that the proportionate distribution of the trace elements in the wear and thus in the surface layer of the bearings is different from the average distribution in the whole bearings. ESA

N86-31909# Optische Werke G. Rodenstock, Munich (West Germany).
NONCONTACT MEASUREMENT OF ROUGHNESS OF GROUND AND POLISHED METAL SURFACES Final Report, Oct. 1983
Rainer Brodmann Bonn, West Germany BMFT Dec. 1985 26 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-T-85-150; ISSN-0340-7608; ESA-86-97438) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.50

An optical roughness measuring instrument consisting of a diode array and an optical system was used for noncontact roughness measurement based on the light scattering method. A microcomputer gives the roughness value, the intensity on the array, and the intensity distributions from the measured intensity values. The measurements can be performed on a static or mobile surface. The characteristics of the instrument are reviewed. Its applications to metal, semiconductor, ceramic, and plastic surfaces are presented. The optical roughness measuring instrument can be used as an automatic measuring station in mass production with synchronous parts feed and measurement recording. ESA

N86-31910# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SEMIACTIVE MAGNETIC BEARINGS FOR SPACE APPLICATION
M. Gauthier and C. Rouyer 1986 7 p Presented at Second ESA European Symposium on Space Mechanisms and Tribology, Schloss Meersburg, West Germany, 9-11 Oct. 1985
(SNIAS-861-422-120; ESA-86-97605) Avail: NTIS HC A02/MF A01

Magnetic bearings developed for space application are compared to ball bearings. The design principles of one axis and two axis systems included in the SPOT satellite design are examined. The function of complementary active centering controls are explained. It is shown that magnetic bearings are advantageous

for high kinetic moment momentum wheels (150 Nms and over) or when redundancy can be avoided due to a better relaibility.
ESA

N86-31911# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Mechanical Engineering.
RESIDUAL STRESS AND DEFORMATION ENERGY UNDER GROUND SURFACES OF BRITTLE SOLIDS
O. Podzimek 23 Apr. 1986 124 p
(WB-85-16; B8664575; ESA-86-98068) Avail: NTIS HC A06/MF A01

Deformation energy accumulated under the surface of brittle solids, especially those of optical glass, during the free abrasive grinding process was analyzed. The distribution of deformation energy density in depth under the ground surface was investigated. A model for the free abrasive grinding process was derived using the deformation energy density experimentally determined in relation to the abrasive size, grinding rate, and input power. The model was validated against a series of relations between process parameters from the literature. ESA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-31912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS THAT AFFECT RELIABILITY OF NONDESTRUCTIVE DETECTION OF FLAWS IN STRUCTURAL CERAMICS
S. J. Klima, G. Y. Baaklini (Cleveland State Univ., Ohio), and D. J. Roth 1986 11 p Presented at the 2nd International Symposium on Ceramic Materials and Components for Engines, Luebeck-Travemuende, West Germany, 14-17 Apr. 1986; sponsored by the German Ceramic Society and the American Ceramic Society
(NASA-TM-87348; E-3096; NAS 1.15:87348) Avail: NTIS HC A02/MF A01 CSCL 14D

The factors that affect reliability of nondestructive detection of flaws in structural ceramics by microfocus radiography and scanning laser acoustic microscopy (SLAM) were investigated. Reliability of void detection in silicon nitride and silicon carbide by microfocus X-rays was affected by photon energy level, material chemistry in the immediate vicinity of the void, and the presence of loose powder aggregates inside the void cavity. The sensitivity of SLAM to voids was affected by material microstructure, the level of porosity, and the condition of the specimen surfaces. Statistical results are presented in the form of probability of detection as a function of void diameter for green compacts and sintered materials. Author

N86-31913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATIVE VOID CHARACTERIZATION IN STRUCTURAL CERAMICS USING SCANNING LASER ACOUSTIC MICROSCOPY
Don J. Roth, Edward R. Generazio, and George Y. Baaklini (Cleveland State Univ., Ohio) 1986 23 p Proposed for presentation at the Basic Science, Electronics and Glass Divisions Joint Meeting, New Orleans, La., 2-5 Nov. 1986; sponsored by American Ceramic Society
(NASA-TM-88797; E-3166; NAS 1.15:88797) Avail: NTIS HC A02/MF A01 CSCL 14D

The ability of scanning laser acoustic microscopy (SLAM) to characterize artificially seeded voids in sintered silicon nitride structural ceramic specimens was investigated. Using trigonometric relationships and Airy's diffraction theory, predictions of internal void depth and size were obtained from acoustic diffraction patterns produced by the voids. Agreement was observed between actual and predicted void depths. However, predicted void diameters were generally much greater than actual diameters. Precise diameter predictions are difficult to obtain due to measurement uncertainty and the limitations of 100 MHz SLAM applied to typical ceramic specimens. Author

N86-31914# Advanced Research and Applications Corp., Sunnyvale, Calif.
A NEW RADIOGRAPHIC CORROSION INSPECTION CAPABILITY Final Report, 2 Jul. 1984 - 2 Jan. 1985
J. H. Stanley and J. J. LePage Jan. 1986 53 p
(Contract F33615-84-C-5089)
(AD-A167270; FR85-352-1; AFWAL-TR-85-4130) Avail: NTIS HC A04/MF A01 CSCL 14/5

A dual-energy radiographic technique is reported which could significantly enhance the corrosion detection and damage assessment capabilities of any radiometric system. Digital radiographs taken at two different effective energies are manipulated in such a way as to greatly improve the conspicuity of detail in the image by reducing the amount of structural noise present. The improved sensitivity offered by the method can be traded for an equivalent detectability at a much lower dose level, an important consideration for on-board or in-situ inspections. In addition, an important consideration when foreign material is present. Results indicate that the effective atomic number of unknown contaminants can be determined to better than 3% absolute error. GRA

N86-31915# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ULTRASONIC INSPECTION OF PARTIALLY COMPLETED WELDS USING PATTERN RECOGNITION TECHNIQUES
N. M. Carlson and J. A. Johnson 1986 8 p Presented at the Quantitative NDE, Williamsburg, Va., 24 Jun. 1986
(Contract DE-AC07-76ID-01570)
(DE86-003227; EGG-M-27784; CONF-860639-1) Avail: NTIS HC A02/MF A01

The feasibility of using automated ultrasonic examination with computer-based pattern-recognition techniques to inspect partially completed welds on a pass-by-pass basis is investigated. In these tests welds are inspected, as they are being made, by an automated ultrasonic search unit attached to the weld head. Flaws are intentionally made in the weld. An analysis of the ultrasonic data collected during this process shows that the flaws can be reliably distinguished from good welds and, further, that two different types of flaws can be differentiated from each other. From this analysis a practical concurrent inspection system is shown to be feasible. DOE

N86-31916# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Computer Sciences.
CUMULATIVE SUM CHARTS [CUMULATIEVE-SOM KAARTEN]
J. Praagman Apr. 1984 23 p In DUTCH
(ARW-03-THE-BDK/ORS/84/13; ESA-86-97701) Avail: NTIS HC A02/MF A01

The concept of statistical process control is presented. The cumulative sum (cusum) techniques are explained. The choice of a reference value and a scale in order to quickly visualize possible changes is discussed. The decision rules required for an efficient use of the cusum chart are outlined. The relation between the choice parameters and the performance of the procedure is discussed. The determination of the average run length is explained. It is concluded that cusum charts can be used on a wider industrial scale. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-31917 Westland Helicopters Ltd., Yeovil (England). Dynamics Dept.

DYNAMIC ANALYSIS: CORRELATION OF THEORY WITH EXPERIMENT Final Report
A. McLaughlin Jun. 1983 94 p
(Contract MODA26B/10)
(RP661; DYN/83/10; BR97157; ESA-86-97258) Avail: Issuing Activity

The NASTRAN finite element system with superelements was used to compute the normal modes of vibration and transfer functions of a helicopter. Using measured model damping factors, transfer functions in the cockpit and cabin areas for main rotor head shear and moment input were synthesized. Fair agreement in mode shape is obtained for the two NASTRAN analyses, but the correlation between the shake test modes and those from the WHL NASTRAN analysis is disappointing. The transfer function correlation is also poor, though better agreement with direct measurement is obtained for the transfer function synthesis from the WHL NASTRAN modes than for the corresponding synthesis from the measured mode shapes. The measured transfer functions could not be synthesized from the measured mode shapes. The aims of the study were not realized in full due to the poor quality of the results from the shake tests. ESA

N86-31918 Instituut TNO voor Bouwmaterialen en Bouwconstructies, Delft (Netherlands).
THE DYNAMIC BEHAVIOR OF WIND TURBINE MASTS (IN THE FRAMEWORK OF WIND TURBINE DESIGN CRITERIA) [ONDERZOEK NAAR HET DYNAMISCH GEDRAG VAN WINDTURBINEMASTEN (IN HET KADER VAN ONTWERPCRITERIA WINDTURBINES)]
J. J. M. Albert, A. Waaldijk, and P. J. vanBrederode Oct. 1985 91 p In DUTCH Prepared for Nationaal Lucht- en Ruimtevaart Lab., Marknesse, Netherlands
(B-85-324; ESA-86-97771) Copyright. Avail: Issuing Activity

The dynamic behavior of wind turbine masts was measured and studied with a model in order to determine the eigenfrequencies. Measurements were performed on a wind turbine on a steel base (i.e., not on piles) and one on piles. The first is a Polenko windmill (type WPS16A60) with a height of 20m and a diameter of 16 m; the second is a Bouma windmill with a height of 25 m and a rotor diameter of 16 m. For the Polenko mill the measured values of the lowest eigenfrequency do not agree with the values predicted in the design; for the Bouma mill no prediction was available. The developed calculation model allows a good prediction of the lowest eigenfrequency for both types of wind turbine assemblies. The rotation spring-constant of the foundation strongly effects the lowest eigenfrequency. ESA

N86-31919 Instituut TNO voor Bouwmaterialen en Bouwconstructies, Delft (Netherlands).
MASTS FOR SMALL WIND TURBINES [MASTLICHAMEN VOOR KLEINE WINDTURBINES]
O. D. Dijkstra Nov. 1985 24 p In DUTCH Prepared for NLR, Emmeloord, Netherlands
(B-85-583; ESA-86-97772) Copyright. Avail: Issuing Activity

Construction types of mast bodies for wind turbines are presented. The most frequently used construction material is steel; concrete is a good alternative for higher towers; brickwork is not so suited due to the dynamic behavior of the wind turbine. The different types of global steel mast forms (free tube, supported tube, case, network of bars) are discussed. The connections between the different parts of a steel mast (welding, bolt, flange plates) and their characteristics are discussed. ESA

N86-31920*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF THIRD-DEGREE GEOMETRIC NONLINEARITIES ON THE VIBRATION AND STABILITY OF PRETWISTED, PRECONED, ROTATING BLADES
K. B. Subrahmanyam and K. R. V. Kaza May 1986 43 p
(NASA-TM-87307; E-2988; NAS 1.15:87307) Avail: NTIS HC A03/MF A01 CSCL 20K

The governing coupled flapwise bending, edgewise bending, and torsional equations are derived including third-degree geometric nonlinear elastic terms by making use of the geometric nonlinear theory of elasticity in which the elongations and shears are negligible compared to unity. These equations are specialized for blades of doubly symmetric cross section with linear variation of pretwist over the blade length. The nonlinear steady state equations and the linearized perturbation equations are solved by using the Galerkin method, and by utilizing the nonrotating normal modes for the shape functions. Parametric results obtained for various cases of rotating blades from the present theoretical formulation are compared to those produced from the finite element code MSC/NASTRAN, and also to those produced from an in-house experimental test rig. It is shown that the spurious instabilities, observed for thin, rotating blades when second degree geometric nonlinearities are used, can be eliminated by including the third-degree elastic nonlinear terms. Furthermore, inclusion of third degree terms improves the correlation between the theory and experiment. M.G.

N86-31921*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
LARGE DEFORMATION DYNAMIC BENDING OF COMPOSITE BEAMS Interim Report, Sep. 1983 - Apr. 1986
E. J. Derian (Global Analytics, Inc., San Diego, Calif.) and M. W. Hyer (Maryland Univ., College Park) Washington NASA Aug. 1986 218 p
(Grant NAG1-343)
(NASA-CR-4006; NAS 1.26:4006) Avail: NTIS HC A10/MF A01 CSCL 20K

Studies were conducted on the large deformation response of composite beams subjected to a dynamic axial load. The beams were loaded with a moderate eccentricity to promote bending. The study was primarily experimental but some finite element results were obtained. Both the deformation and the failure of the beams were of interest. The static response of the beams was also studied to determine potential differences between the static and dynamic failure. Twelve different laminate types were tested. The beams were loaded dynamically with a gravity driven impactor traveling at 19.6 ft/sec and quasi-static tests were conducted on identical beams in a displacement controlled manner. For laminates of practical interest, the failure modes under static and dynamic loadings were identical. Failure in most of the laminate types occurred in a single event involving 40% to 50% of the plies. However, failure in laminates with 30 deg or 15 deg off-axis plies occured in several events. All laminates exhibited bimodular elastic properties. Using empirically determined flexural properties, a finite element analysis was reasonably accurate in predicting the static and dynamic deformation response. Author

N86-31922# Wisconsin Univ., Madison. Mathematics Research Center.
ZERO AND NEGATIVE MASSES IN FINITE ELEMENT VIBRATION AND TRANSIENT ANALYSIS Technical Summary Report
David S. Malkus and Michael E. Plesha Feb. 1986 31 p
(Contract DAAG29-80-C-0041)
(AD-A167489; MRC-TSR-2915) Avail: NTIS HC A03/MF A01 CSCL 12/1

Mass matrix lumping by quadrature is considered. Accuracy requirements seem to dictate the use of zero negative masses for multi-dimensional higher-order elements. It is shown that the zero and/or negative masses do not destroy the essential algebraic properties of the discrete eigen problems, in spite of the negative or infinite eigenvalues which may result. Explicit transient methods require positive definite lumping which, for some elements, may only be achieved by sacrificing accuracy to avoid the negative or zero masses that would render the lumping indefinite. An implicit-explicit time integration method based on quadratic triangles with optimal lumping is devised, analysed, and tested. It treats the nodes with nonzero masses explicitly and the nodes with zero masses implicitly. Analysis and numerical tests show that this

formulation is optimally accurate and less costly than a similar method with nonzero masses, based on optimally lumped biquadratic rectangles. The method is also found to be substantially more accurate than the fully explicit method based on lumping the triangular elements in an ad-hoc fashion to retain non-zero masses. Author (GRA)

N86-31923# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION INTO THE TRIPPING BEHAVIOR OF LONGITUDINALLY T-STIFFENED RECTANGULAR FLAT PLATES LOADED STATICALLY AND IMPULSIVELY M.S. Thesis
Howard L. Budweg Mar. 1986 101 p
(AD-A167718) Avail: NTIS HC A06/MF A01 CSCL 13/13

An experimental investigation was conducted to determine the static and dynamic responses of a specific stiffened flat plate design. The air-backed rectangular flat plates of 6061-T6 aluminum with an externally machine longitudinal narrow-flanged T-stiffener and clamped boundary conditions were subjected to static loading by water hydropump pressure and shock loading from and eight pound TNT charge detonated underwater. The dynamic test plate was instrumented to measure transient strains and free-field pressure. The static test plate was instrumented to measure transient strains, plate deflection, and pressure. Emphasis was placed upon forcing static and dynamic stiffener tripping, obtaining relevant strain and pressure data, and studying the associated plate-stiffener behavior. Author (GRA)

N86-31924# Naval Postgraduate School, Monterey, Calif.
COMPOSITE STRUCTURAL RELIABILITY CALCULATION BY FINITE ELEMENT AND STATISTICAL STRENGTH THEORY M.S. Thesis
Pattama Suttisornyotin Mar. 1986 86 p
(AD-A167890) Avail: NTIS HC A05/MF A01 CSCL 20/11

The reliability of the structure can be calculated by combining the non-uniform stress distribution of a structure from finite element analysis with the statistical strength theory under two dimensional nonhomogeneous, uniaxial stress limitations. The specimen models with and without notch are the sample structures to illustrate the calculations. The statistical strength of the structure is cast in the standard Weibull form characterized by the structural scale parameter, Beta E and shape parameter, Alpha E which are functions of the material scale shape parameters (Alpha and Beta.) Therefore, this thesis demonstrated that the scale parameter of the structure remains constant for different load magnitude, only the structural geometry and loading condition cause the change of material scale parameter, Beta to the structural scale parameter, Beta E. The results also shows that the degree of uniformity of stress within structural element and the linearity of the load magnitude and stress distribution within the structure affect the accuracy for the calculation. GRA

N86-31925# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
STUDIES OF STRESS AND FATIGUE INDUCED DEFECTS USING SMALL ANGLE NEUTRON SCATTERING
J. R. Weertman 1985 11 p Presented at the Workshop on Atomic Transport and Defects in Metals By Neutron Scattering, Julich, West Germany, 2 Oct. 1985
(Contract DE-AC02-81ER-10960)
(DE86-004985; CONF-8510279-1) Avail: NTIS HC A02/MF A01

The technique of small angle neutron scattering (SANS) is proving to be of great value in the study of deformation-induced defects in various materials. Frequently SANS is the only practicable method for obtaining detailed, quantitative information on the kinetics of defect production. In crystalline material, the following defects produced by deformation are most amenable to study by SANS: bulk microcracking in brittle material; voids, bubbles and vacancy clusters; dislocations. If a broad definition is adopted for the types of defects to be considered, we can include the accelerated coarsening of particles and precipitates produced by high temperature deformation. To date the greatest success with SANS in the study of defects associated with stress has been achieved with cavities (voids, etc.) and microcracks. The presence of dislocations can be detected by neutron scattering, but more extensive data on their nature, disposition and density usually can be obtained readily by TEM examination of thin foils. Accordingly, emphasis in this review is on those defects for which neutron scattering has yielded detailed information not readily available by other methods. DOE

N86-31926# Sandia National Labs., Albuquerque, N. Mex.
SWAY85: A COMPUTER PROGRAM FOR CALCULATING LUG AND SWAY BRACE LOADS
R. P. Rechard and P. K. Metzler Mar. 1986 88 p
(Contract DE-AC04-76DP-00789)
(DE86-009550; SAND-85-2178) Avail: NTIS HC A05/MF A01

The computer program, SWAY85, evaluates the lug and case loads on airborne stores (bombs, missiles, drop tanks) resulting from aircraft maneuvers and aerodynamic forces during flight according to the procedure suggested in the US military specification, MIL-A-8591G. This report describes the input and relations solved. SWAY85 uses input features (for example, control keywords along with a free-field reader) to make the code user-friendly and, consequently, less prone to input errors. In addition several data preparation aids are used. These aids include calculation of the dynamic pressure, interpolation of aerodynamic data, calculation of margins of safety if failure envelopes are supplied, and tabulation of up to 25 lowest margins of safety (or alternatively largest forces) for the sway braces and the forward and aft lugs. Furthermore, SWAY85 handles both large and small groups of data gracefully by permitting both ASCII and binary file input. DOE

N86-31927# Allied Bendix Corp., Kansas City, Mo.
INVESTIGATION OF ULTRASONIC METHODS FOR RESIDUAL STRESS MEASUREMENT
G. D. Swanson Apr. 1986 44 p
(Contract DE-AC04-76DP-00613)
(DE86-009614; BDX-613-3490) Avail: NTIS HC A03/MF A01

Three ultrasonic methods were investigated for nondestructively measuring residual stress in metals. Shear wave birefringence using a multiarticulated sample positioner and motorized transducer rotator was found to be very sensitive, but the results strongly depend on the matrial texture. Rayleigh wave measurements using a corner reflector and motorized goniometer have marginal sensitivity, but alternate methods using wedge, knife edge, or needle point contacts have sensitivity comparable to shear wave birefringence. The use of wave-propagation coefficients in conjunction with combinations of measurement methods appears to be at least as promising a technique as use of shear horizontal waves and promises to require much smaller transducers. DOE

N86-31928# Sandia National Labs., Albuquerque, N. Mex.
SNLL MATERIALS TESTING COMPRESSION FACILITY
W. A. Kawahara, S. L. Brandon, and J. S. Korellis Apr. 1986 25 p
(Contract DE-AC04-76DP-00789)
(DE86-009984; SAND-86-8219) Avail: NTIS HC A02/MF A01

This report explains software enhancements and fixture modifications which expand the capabilities of a servo-hydraulic test system to include static computer-controlled constant true strain rate compression testing on cylindrical specimens. True strains in excess of -1.0 are accessible. Special software features include schemes to correct for system compliance and the ability to perform strain-rate changes; all software for test control and data acquisition/reduction is documented. DOE

N86-31929# Los Alamos National Lab., N. Mex.
FOUNDATIONS OF STATISTICAL CRACK MECHANICS
J. K. Dienes 1986 7 p Presented at the International Symposium on Intense Dynamic Loading and Its Effects, Beijing, China, 3 Jun. 1986
(Contract W-7405-eng-36)
(DE86-000764; LA-UR-85-3264; CONF-860616-5) Avail: NTIS HC A02/MF A01

The principle of superposition of elastic and plastic strain rates

in regions of plastic flow was hypothesized by Reuss in order to provide a smooth transition of the stresses between regions of elastic and elastic-plastic deformation. In this paper a generalization of this hypothesis is derived which allows for the formulation of more complex constitutive laws that can account for simultaneous plastic flow, fracture, fragmentation, and changes in porosity. Such processes can occur during impact, explosions and earthquakes. The possibility of analyzing such processes by finite element methods has been made possible by the advent of large scale computers, but most practioners agree that more general constitutive laws are required to account adequately for the complex flow processes involved. DOE

N86-31930# Los Alamos National Lab., N. Mex.
TECHNIQUE FOR MEGABAR CONTROLLED STRAIN EXPERIMENTS
K. P. Staudhammer and K. A. Johnson 1986 7 p Presented at the International Symposium on Intense Dynamic Loading and its Effects, Beijing, China, 3 Jun. 1986
(Contract W-7405-eng-36)
(DE86-000805; LA-UR-85-3389; CONF-860616-4) Avail: NTIS HC A02/MF A01

This design allows in one shot one experiment a range of pressures from 12 to 170 GPa and a selectable strain range (0 to 55%) in 304 stainless steel with 100% recovery. Development of the application of griding has enabled correlation, locally, of pressure and strain with structure and properties at a strain rate of 10(6)/s. Appropriate variations in momentum trap design can control strain in cylindrical implosion shock experiments. Pedestal type traps have shown significant improvement in the reduction of strain in cylindrical implosion experiments. Such design would seem to be appropriate for experiments on brittle and ceramic materials. In cylindrical designs the degree of macro-strain is a function of trapping and is the result of reflected waves not the primary shock pulse. DOE

N86-31931# Sandia National Labs., Albuquerque, N. Mex.
MICROSCOPIC IMAGE ANALYSIS OF SLOW CRACK GROWTH IN VITREOUS MATERIALS
W. L. Smith Apr. 1986 7 p Presented at the 88th Annual Meeting of the American Ceramic Society, Chicago, Ill., 27 Apr. 1986
(Contract DE-AC04-76DP-00789)
(DE86-009850; SAND-86-1024C; CONF-860418-3) Avail: NTIS HC A02/MF A01

Automated computer control, advanced video techniques, and digital image processing have been integrated into a servo-hydraulic testing system to produce a state-of-the-art testing environment. This system, in combination with an ultra high vacuum controlled environmental chamber, is used to produce high accuracy, subcritical slow crack growth data in vitreous materials. This video presentation is a review of the technologies used to extract data from the double cleavage drilled compression (DCDC) sample geometry. DOE

N86-31932# Sandia National Labs., Albuquerque, N. Mex.
X-RAY LINE PROFILE ANALYSIS OF SHOCK-MODIFIED COMPOUNDS
B. Morosin, R. A. Graham, Y. Zhang, and J. M. Stewart 1986 8 p Presented at the International Symposium on Intense Dynamic Loading and its Effects, Beijing, China, 3 Jun. 1986 Prepared in cooperation with Maryland Univ., College Park
(Contract DE-AC04-76DP-00789)
(DE86-003454; SAND-85-2412C; CONF-860616-7) Avail: NTIS HC A02/MF A01

The overall assessment revealed by the extensive studies show that large plastic deformation as evidenced by residual lattice strain is introduced at peak pressures of 7.5 GPa or lower. For various refractory materials, both coherent domain size and residual lattice strain depend strongly on shock conditions (pressure and temperature) and on specific material properties. There is evidence for defect configurations which differ from those produced by more conventional methods. The high residual strain values resulting from the large intense plastic deformation on these normally brittle refractory materials are more typical of those determined in heavily cold worked metals. The behavior is consistent with the unusual nature of the shock deformation process. Such shock-modified materials have been shown to exhibit increased chemical reactivity in a manner that should influence material processing procedures. DOE

N86-31933# Argonne National Lab., Ill.
ANALYSIS OF THE FELIX EXPERIMENTS WITH CANTILEVERED BEAMS AND HOLLOW CYLINDERS
L. R. Turner, T. Q. Hua, and S. Y. Lee 1986 44 p Presented at the 4th Eddy Current Seminar, Chilton, England, 24 Mar. 1986
(Contract W-31-109-eng-38)
(DE86-010528; CONF-8603116-1) Avail: NTIS HC A03/MF A01

Experiments have been performed with the FELIX facility at Argonne National Laboratory to study the coupling between eddy currents and deflections and to provide data for validating eddy current computer programs. Experiments with cantilevered beams in crossed steady and decaying magnetic fields verify that coupling effects act to alleviate the large currents, deflections, and stresses predicted by uncoupled analyses. Measurements of magnetic fields induced in conducting hollow cylinders are analyzed by exponential fitting and by transfer functions. Spatial variation in the parameters of the exponential fit and in those of the one- and two-pole transfer functions suggests that several eddy current modes are acting in the cylinder test pieces. DOE

N86-31934# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Anlagentechnik.
FINITE ELEMENT ANALYSIS TO EVALUATE THE STRESS DISTRIBUTION AND THE ENERGY RELEASE RATE AT THE CRACKING FRONT OF A FRACTURE MECHANICS SPECIMEN FOR LINEAR AND NONLINEAR MATERIAL BEHAVIOR [FINITE-ELEMENT-ANALYSE ZUR BEURTEILUNG DER SPANNUNGSVERTEILUNG UND ENERGIEFREISETZUNGSRATE AN DER RISSSPITZE EINER BRUCHMECHANIKPROBE BEI LINEAREM UND NICHTLINEAREM MATERIALVERHALTEN]
R. Dietrich 2 Dec. 1985 63 p In GERMAN; ENGLISH summary (GKSS-85/E/54; ISSN-0344-9629; ESA-86-97410) Avail: NTIS HC A04/MF A01

The distribution of stresses and the energy release rate near the cracking front of specimen and component welded underwater were analyzed using a finite element method in order to predict their loading capacity. The incremental continuum mechanics equations of motion are formulated. The finite element discretization and the numerical solution of the finite element equations (modified Newton-Raphson iteration and Broyden-Fletscher-Goldbard-Shanno method) are explained. The linear and nonlinear material behavior of a fracture mechanics specimen was investigated. It is shown that theory and calculation programs provide information about the structural-mechanics behavior of the specimen if, in the presence of welding internal stresses and loading stresses, statements about stress intensity factors calculated from the J-integral have to be taken into account. ESA

N86-31935# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
SOLUTION OF THE PROBLEM OF ELASTOPLASTIC TORSION WITH A FINITE ELEMENT METHOD [OPLOSSING VAN HET PROBLEEM VAN DE ELASTOPLASTISCHE TORSIE MET EEN EINDIGE ELEMENTEN METHODE]
J. M. F. Peters Aug. 1984 119 p In DUTCH
(ESA-86-97546) Avail: NTIS HC A06/MF A01

The problem of the elastoplastic torsion of a cylindrical bar made of an ideal-plastic, homogenous, isotropic material, was solved using a numerical method. A variational formulation was applied to eliminate the interface between the elastic and plastic area. Only the gradient of the stress function, i.e., the sectional shear stress, occurs as a variable in this formulation, introducing a divergence freedom condition. Using a finite element method, stress components were approximated by constant functions. The obtained convex minimization problem was solved with a saddle

point algorithm for an appropriate Lagrangian, in which only the inequality limitations were accounted for. Numerical results show a very slow convergence of the optimization algorithm (especially for the finer distributions). A more efficient solution for a bar with certain symmetry characteristics is discussed. ESA

N86-31936# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
USE OF A SPECIAL FINITE ELEMENT FOR THE STATIC ANALYSIS OF NORMAL INTERFACIAL STRESSES
Gilles Bourdeau 1986 18 p In FRENCH; ENGLISH summary Presented at DRET Conference at Tendances Actuelles en Calcul des Structures, Bastia, France, 6-8 Nov. 1985
(SNIAS-861-422-109; ESA-86-97597) Avail: NTIS HC A02/MF A01

A finite element is defined following Hellinger-Reissner's variational principle and Verchery's idea. The normal interface stresses become nodal unknowns, which supplies a better estimation of their value. A function is obtained and applied to axisymmetric problems and orthotropic materials. For the partition in finite elements, an isoparametric element is used. The meridian line is an eight node quadrilateral. Two computations having a known analytical solution are used to test the method. It is shown that the proposed element is very helpful when a displacement method is used. ESA

N86-31937# Technische Hogeschool, Eindhoven (Netherlands). Onderafdel. der Wiskunde en Informatica.
ELASTOPLASTIC TORSION OF A CYLINDRICAL BEAM, DESCRIBED BY VARIATIONAL INEQUALITIES [ELASTOPLASTISCHE TORSIE VAN EEN CYLINDRISCHE BALK, BESCHREVEN MET BEHULP VAN VARIATIONELE ONGELIJKHEDEN]
J. J. E. IndenKleef Apr. 1984 103 p In DUTCH
(ESA-86-97704) Avail: NTIS HC A06/MF A01

The elastoplastic torsion problem of a cylindrical beam was investigated. The method of variational inequalities was applied to solve this minimalization free boundary problem. The problem was discretized to allow a numerical solution using the finite element method. The numerical solution is based on the method of (over) relaxation with projection. One variational inequality contains simple constraints, the other inequality contains difficult constraints, so-called gradient constraints. Due to these conditions existing finite element packages could not be used; the method had to be implemented using simple elements and linear approximations. Estimates for the discretization errors due to the approximations are given. The numerical solution shows that theoretically deduced error estimates are not optimal. ESA

N86-31938# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
STRESSES IN THE REGION OF ROUNDED CORNERS
J. P. Benthem May 1985 28 p
(WTHD-174; Rept-808; ESA-86-97710) Avail: NTIS HC A03/MF A01

The stress fields in the neighborhood of corners rounded by a small radius, if only the participation factor of the dominant eigenstate of the nonrounded sharp corner is computed, are derived. Results for wedges of arbitrary angles between pi and 2 pi for modes 1, 2, and 3 are given. The method was verified by comparison with the exact solution for mode 3. Such an exact solution is not possible for modes 1 and 2. ESA

N86-31939# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
STABILITY OF A RUBBER HALF-SPACE, PART 2
P. Meijers Jul. 1985 60 p
(WTHD-176-Pt-2; Rept-793-Pt-2; ESA-86-97711-Pt-2) Avail: NTIS HC A04/MF A01

The effect of buckling modes on the buckling behavior of a rubber half space in the neighborhood of the bifurcation point was studied. It turns out that the line of steepest descent in the postbuckling behavior becomes increasingly steeper as an increasing number of buckling modes are added. This suggests that the retaining of third order terms of the potential energy function alone yields solutions which are valid only in a very small neighborhood of the bifurcation point. Fourth order terms in the asymptotic expansion are needed to extend the region where the solution yields a sufficiently accurate approximation. But routine inclusion of the fourth order terms leads to singular solutions at the critical load owing to the contributions of the remaining buckling modes. A way to get around this difficulty is indicated. ESA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-31940* National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 50
1986 146 p
(NASA-SP-7041(50); NAS 1.21:7041(50)) Avail: NTIS HC A07 CSCL 05B

This bibliography lists 523 reports, articles and other documents introduced into the NASA scientific and technical information system between April 1 and June 30, 1986. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N86-31941*# California Univ., Santa Barbara. Dept. of Geography.
COVER PROJECT AND EARTH RESOURCES RESEARCH TRANSITION Final Technical Report
Daniel B. Botkin and John E. Estes, principal investigators 1986 46 p
(Contract NCC9-13)
(NASA-CR-177176; NAS 1.26:177176) Avail: NTIS HC A03/MF A01 CSCL 05B

Results of research in the remote sensing of natural boreal forest vegetation (the COVER project) are summarized. The study objectives were to establish a baseline forest test site; develop transforms of LANDSAT MSS and TM data for forest composition, biomass, leaf area index, and net primary productivity; and perform tasks required for testing hypotheses regarding observed spectral responses to changes in leaf area index in aspen. In addition, the transfer and documentation of data collected in the COVER project (removed from the Johnson Space Center following the discontinuation of Earth resources research at that facility) is described. M.G.

N86-31942*# Oklahoma Univ., Norman. Cooperative Inst. for Mesoscale Meteorolog. Study.
DEVELOPMENT OF A VARIATIONAL SEASAT DATA ANALYSIS TECHNIQUE Final Report
Yoshi K. Sasaki, Lang-Ping Chang, and James S. Goerss (Naval

Environmental Prediction Research Facility, Monterey, Calif.) Apr. 1986 50 p
(Grant NAG5-289)
(NASA-CR-177175; NAS 1.26:177175) Avail: NTIS HC A03/MF A01 CSCL 05B

Oceans are data-sparse areas in terms of conventional weather observations. The surface pressure field obtained solely by analyzing the conventional weather data is not expected to possess high accuracy. On the other hand, in entering asynoptic data such as satellite-derived temperature soundings into an atmospheric prediction system, an improved surface analysis is crucial for obtaining more accurate weather predictions because the mass distribution of the entire atmosphere will be better represented in the system as a result of the more accurate surface pressure field. In order to obtain improved surface pressure analyses over the oceans, a variational adjustment technique was developed to help blend the densely distributed surface wind data derived from the SEASAT-A radar observations into the sparsely distributed conventional pressure data. A simple marine boundary layer scheme employed in the adjustment technique was discussed. In addition, a few aspects of the current technique were determined by numerical experiments. Author

N86-31943*# National Marine Fisheries Service, Miami, Fla.
UTILIZING REMOTE SENSING OF THEMATIC MAPPER DATA TO IMPROVE OUR UNDERSTANDING OF ESTUARINE PROCESSES AND THEIR INFLUENCE ON THE PRODUCTIVITY OF ESTUARINE-DEPENDENT FISHERIES Semiannual Progress Report
Joan A. Browder, L. Nelson May, Jr. (Louisiana State Univ., Baton Rouge), Alan Rosenthal, Robert H. Baumann, and James G. Gosselink 10 Jun. 1986 66 p Sponsored by NASA
(NASA-CR-177177; NAS 1.26:177177; SAPR-2) Avail: NTIS HC A04/MF A01 CSCL 08G

LANDSAT thematic mapper (TM) data are being used to refine and validate a stochastic spatial computer model to be applied to coastal resource management problems in Louisiana. Two major aspects of the research are: (1) the measurement of area of land (or emergent vegetation) and water and the length of the interface between land and water in TM imagery of selected coastal wetlands (sample marshes); and (2) the comparison of spatial patterns of land and water in the sample marshes of the imagery to that in marshes simulated by a computer model. In addition to activities in these two areas, the potential use of a published autocorrelation statistic is analyzed. Author

N86-31944*# Rochester Inst. of Tech., N. Y. School of Photographic Arts and Sciences.
LANDSAT 4 BAND 6 DATA EVALUATION Quarterly Report
15 Sep. 1984 6 p
(Contract NAS5-27323)
(NASA-CR-177173; NAS 1.26:177173; QR-8) Avail: NTIS HC A02/MF A01 CSCL 05B

The objectives of this investigation are to evaluate and monitor the radiometric integrity of the LANDSAT-D Thematic Mapper (TM) thermal infrared channel (Band 6) data to develop improved radiometric preprocessing calibration techniques for removal of atmospheric effects. Efforts this period have concentrated on underflight data collection. Two successful flights were made on September 18 and October 6. The radiosonde data for these flights have been obtained. Author

N86-31945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT-4 AND LANDSAT-5 MULTISPECTRAL SCANNER COHERENT NOISE CHARACTERIZATION AND REMOVAL
James C. Tilton and William L. Alford, principal investigators (Defense Mapping Agency, Washington, D.C.) May 1986 46 p Original contains color illustrations
(NASA-TP-2595; Rept-86B0040; NAS 1.60:2595) Avail: NTIS HC A03/MF A01 CSCL 14B

A technique for characterizing the coherent noise found in LANDSAT-4 and LANDSAT-5 multispectral scanner (MSS) data is described along with a companion technique for filtering out the coherent noise. The techniques are demonstrated on LANDSAT-4 and LANDSAT-5 MSS data sets, and explanations of the noise pattern are suggested. A cookbook procedure of characterizing and filtering the coherent noise using special NASA/Goddard IDIMS functions is included. Also presented are analysis results from the retrofitted LANDSAT-5 MSS sensor which shows that the coherent noise has been substantially reduced. Author

N86-31946# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 95 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: HEFT NR. 95]
1985 200 p In GERMAN; ENGLISH summary. Original contains color illustrations Document contains maps as supplement
(ISSN-0469-4236; ESA-86-97479) Avail: NTIS HC A09/MF A01

Research on automated cartography (data acquisition, processing and retrieval) with economical use and feasibility analyses is reported. Development of data bases, user interfaces and interactive graphical systems is described. Image processing and resolution are improved. For individual titles, see N86-31947 through N86-31962.

N86-31947# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON DATA INTEGRITY OF CAD APPLICATIONS IN CARTOGRAPHY: CONCEPT OF AN INFORMATION SYSTEM WITH SIEMENS COMPUTER AIDED DESIGN (SICAD) [ZUR DATENHALTUNG VON CAD-ANWENDUNGEN IN DER KARTOGRAPHIE. KONZEPT EINES INFORMATIONSSYSTEMS MIT SICAD]
Martin Baumann *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 7-27 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The Geographic Data Base, a building block of the interactive graphic system Siemens Computer Aided Design (SICAD) which facilitates the establishment of information systems is presented. The connection between factual data and graphical components is discussed. The SICAD software structure includes modules for cadastral, ground cleaning, supply network, and planning applications. ESA

N86-31948# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GEOSCIENTIFIC REQUIREMENTS ON A GRAPHICAL DATA BASE [GEOWISSENSCHAFTLICHE ANFORDERUNGEN AN EINE GRAPHISCHE DATENBANK]
Juergen Bollmann *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 29-42 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

Design of a graphical data bank interface, storage procedures, and organization of spatial data are studied. The graphical data bank function and elements, and the structure of an object field are described. The relationship between objects and operations with objects are presented. The geoscientific requirements on a graphical data bank are reviewed. ESA

N86-31949# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TOPOGRAPHIC-CARTOGRAPHIC DATA BASE IN STANDARDIZATION [DIE TOPOGRAPHISCH-KARTOGRAPHISCHE DATENBANK IN DER STANDARDISIERUNG]
Heinz Brueggemann *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 43-54 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

Standardization for data structure management and transfer based on standardized terminology and taxonomy is studied to develop a national information system. The topographic cartographic data base, automated cartographic production and

communication are described as well as applications on an interactive graphical work station. Operational user's interface to the data base, standard data format and language are mentioned for standardization. ESA

N86-31950# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROPOSAL FOR THE DEVELOPMENT OF A LARGE-SCALE TOPOGRAPHIC-CARTOGRAPHIC DATA BASE TAKING THE PLANIMETRIC DATA OF AUTOMATED CADASTRAL MAP (ALK) SYSTEM INTO ACCOUNT [EIN VORSCHLAG ZUM AUFBAU EINER GROSSMASSTAEBIGEN TOPOGRAPHISCH-KARTOGRAPHISCHEN DATENBANK UNTER BESONDERER BERUECKSICHTIGUNG DER GRUNDRISSDATEI DES ALK-SYSTEMS]
Dietmar Gruenreich *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 55-70 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The database system developed in computer-assisted production, revision and use of cadastral maps in digital form is used to establish a large-scale topographic-cartographic data base (1:5,000). Cadastral maps with 70% of the planimetric information of topographic maps are one of the most important sources for the conventional production and revision of the German Basic Map 1:5,000 (DGK 5). A digital data interconnection system between digital cadastral maps (ALK) and the Digital Landscape Model 1:5,000 (DLM 5) is proposed. A graph theory-based procedure for automatic generalization of digital cadastral maps is described. Topographic information which can not be derived from cadastral maps is to be gained using digital photogrammetric procedures and linked to the ALK data. Applications in geosciences, spatial planning, and cartographic generalization for small-scale DLM are shown. ESA

N86-31951# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
HARDWARE FOR DATA BANKS IN CARTOGRAPHY: CONCEPTS [HARDWARE FUER DATENBANKEN IN DER KARTOGRAPHIE: KONZEPTE]
Horst Kremers *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 71-89 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

Computer architectures suitable for work with data bank systems are presented. Hardware and software aspects are treated together in large systems for application of special processors and memories which can increase the system efficiency. Concepts applicable in design and function of modules of a data base computer for cartographic applications are reviewed. The use of dedicated hardware components can contribute to system optimization. Mutual software and hardware dependencies lead to feedback in design. Expert systems and ergonomical applications supported by subject-related artificial intelligence can be created by applying such special data bank computers in cartography. ESA

N86-31952# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTOMATIC INTERPOLATION OF ISOLINES FROM AN IRREGULAR WATERLINE DIGITAL TERRAIN MODEL (DGM) THROUGH TRIANGULATION NETWORK [AUTOMATISCHE ABLEITUNG VON ISOLINIEN AUS EINEM UNREGELMAESSIGEN WASSERLINIEN-DGM UEBER DREIECKSVERMASCHUNG]
Ingo Kruse *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 91-99 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

A computer-based waterline procedure was extended to represent drying tidal flat area aerial photographs in digital and analog forms. The triangulation network transforms waterlines into isolines after data homogeneization. The procedure can be applied to process and represent digitized elevation lines. ESA

N86-31953# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
NEW ARRAY PROCESSORS OF FLOATING POINT SYSTEMS [NEUE ARRAY-PROZESSOREN VON FLOATING POINT SYSTEMS] c60
Bernd Lauer *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 101-105 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The array processor series FPS-5000 increases the computation capacity required for digital signal and image processing at low cost. It is used for demodulation/signal analysis, CT processing, multispectral classification, 2D complex Fast Fourier Transformation (FFT), matrix multiply. The array processor of floating point systems is made of a concentration of VLSI circuits and can be connected to a host computer. A typical FPS-5000 system consists of a control processor, arithmetic coprocessors, a system common memory and input/output processors. It allows a computation capacity of up to 62 million floating point operations/sec. ESA

N86-31954# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPRODUCTION OF TOPOGRAPHIC MAP 1:200000 IN DIGITAL RASTER MODE [REPRODUKTION DER TOPOGRAPHISCHEN UEBERSICHSTKARTE 1:200000 IM DIGITALEN RASTERMODUS]
Heinz Meurisch and Wigand Weber *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 107-114 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

Reproduction of a photographic map 1:200,000 in primary and mixed color print by digital raster techniques is reported. Digital raster technique is based on transformation of a map into a matrix of quadratic raster points or pixels using an electronic data processing system. The operational steps of data acquisition, preparation of printing and production of printing film in digital raster mode are explained and time requirements are given. Results show improvement compared to the conventional photomechanical process. Digital raster mode can not be applied economically for reproduction of mixed and primary color printing due to high time requirements. ESA

N86-31955# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INTRODUCTION TO THE PROJECT DESIGN OF A USER'S INTERFACE FOR GRAPHIC-ALPHANUMERICAL DATA BANKS [EINFUEHRUNG IN DAS PROJEKT ENTWURF EINER BENUTZERSCHNITTSTELLE FUER EINE GRAPHISCH-ALPHANUMERISCHE DATENBANK] c82
Isa Ramm and Hans-Dieter Ehrich *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 115-123 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The advantages of a data bank system application in digital geoscientific map production and management are studied to develop a graphic-alphanumerical data bank meeting the users requirements. The efficiency, portability, adaptability and capacity of the data bank as well as the graphic data bank layout are described. The work schedule for geo data bank design is sketched. ESA

N86-31956# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CALCULATION AND REPRESENTATIONS OF ELEVATION CHANGES IN A TIDAL FLAT AREA FROM DIGITAL TERRAIN MODELS [BERECHNUNG UND DARSTELLUNG VON HOEHENVERAENDERUNGEN IM WATT AUS DIGITALEN GELAENDEMODELLEN]

Hartmut Rosengarten *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 125-133 In GERMAN; ENGLISH summary Original contains color illustrations (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The tidal flat areas along the German North Sea coast subjected to large changes by the influence of tide and extreme meteorological conditions are studied to protect man against sea intrusions and hazards. The tidal flat areas are studied using electronic tachymetry, photogrammetry with water line procedures, hydrographic measurements and through aerial photograhy. The data are stored in a data bank and used to calculate elevation changes in tidal flat areas and improve the information on topographic maps. The cartographic representation of elevation changes is described. Map production through increased automation of the partial processes in map design and in reproduction can be economically applied. ESA

N86-31957# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BRIEF REPORT ON DESIGN AND IMPLEMENTATION OF A DATA BANK CORE SYSTEM [KURZBERICH UEBER ENTWURF UND IMPLEMENTIERUNG EINES DATENBANKKERN-SYSTEMS] c82
Hans-Joerg Schek *In its* Reports on Cartography and Geodesy. Series 1: Original reports, No. 95 1985 p 135-141 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

The applicability of a modular data bank system to digital geoscientific mapping is studied. The data bank components forming the cartography interface basis have a layered architecture. The architecture of a geodatabank core system consists of a catalog manager, a geodata manager, data recovery, a version manager, a complex record manager, a permanent storage unit and a buffer. The modular data bank core system can be used for geoscientific applications. ESA

N86-31958# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL ELEVATION FOR THE BADEN-WURTTEMBURG LAND (WEST GERMANY) [DAS DIGITALE HOEHENMODELL FUER DAS LAND BADEN-WUERTTEMBERG]
Manfred Sigle *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 143-154 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

For an area covering 36,000 sqkm, vertical profiles are recorded analogously, 80 m apart, on storage plates for orthoprojector operation. The profiles are digitized and used for the interpolation of a digital elevation model in the form of a 50 m grid. Interpolation, storage and application of the digital elevation model are achieved through program SCOP allowing a processing capacity of 100,000 terrain points. Processing of the 16 million profile points with correction of systematic data errors is described. The computation cost of the digital elevation model is discussed. ESA

N86-31959# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A SOFTWARE CONCEPT FOR INTERACTIVE LETTER LOCATION THROUGH DIGITAL IMAGE PROCESSING [EIN SOFTWAREKONZEPT ZUR INTERAKTIVEN SCHRIFTPLAZIERUNG MITTELS DIGITALER BILDVERARBEITUNG] c61
Ulrich Theissing *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 155-162 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

A system which allows the interactive location of letters and meets cartographic requirements is presented. For representation of the letter on the screen an image resolution of two lines per millimeter is applied. An example is produced with a system core already implemented to study its feasibility. Results show good quality of the letter and that the program should be improved by progressive integration of signature location and map frame and map boundary representation. ESA

N86-31960# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL GEOSCIENTIFIC CARTOGRAPHY: A LEADING PROGRAM OF THE GERMAN RESEARCH COMMUNITY [DIGITALE GEOWISSENSCHAFTLICHE KARTENWERKE - EIN NEUES SCHWERPUNKTPROGRAMM DER DEUTSCHEN FORSCHUNGSGEMEINSCHAFT]
Renier Vinken *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 163-173 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

Computer techniques for the survey, design, production and evaluation of geoscientific maps are presented. Preparation and utilization of the terrain data, laboratory and remote sensing data, the development of geoscientific basic maps and evaluation maps, updating of the basic data and continuity of gooscientific cartography are included. Data acquisition and preparation, data transfer, storage and management, data processing and data retrieval and automated cartography are included. Economical application of graphical interactive screens, control and processing computers and image machines in geoscientific mapping are discussed. ESA

N86-31961# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THREE-DIMENSIONAL VIEWS OF CARTOGRAMS IN DIGITAL RASTER MODE [SCHEINPLASTISCHE DARSTELLUNGEN VON KARTOGRAMMEN IN DIGITALEN RASTERMODUS]
Wigand Weber *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 175-189 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

A digital raster method for producing three-dimensional views of cartograms (choropleth maps) and layered maps of real or thematic mountainous regions (continuous phenomena) is outlined. The three-dimensional view is achieved either by (a) oblique parallel projections of imagined prisms (cylinders) or stepped cones of different height onto a vertical plane taking hidden areas into consideration (hidden-surface removal) or (b) by producing a stereo mate to the parallel projection from (a). System (a) consists in successively moving up the thematic areas or hypsometric layers to their final level while erasing previously generated elements of representation. In this procedure an algorithm operating on a hierarchic basis can save much computing time. The stereo mate according to (b) is formed by repeating the process after slightly changing the given direction of view. ESA

N86-31962# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A RECENT CONCEPT FOR APPLICATION OF INTERACTIVE GRAPHICAL DATA PROCESSING IN CADASTRAL MAP REVISIONS [EIN AKTUELLES KONZEPT ZUM EINSATZ DER INTERAKTIVEN GRAPHISCHEN DATENVERARBEITUNG BEI DER FLURKARTENERNEUERUNG]
Hans Wiens *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 191-200 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

A computer aided revision of cadastral maps is developed and tested to assess its feasibility. Map acquisition procedure through digitizing and map connection procedure are presented. Results show the precision of the maps and the advantages of the modular layout of the program system. Numerical processing and operation at a graphical interactive work station improve the map image. The program system is the basis for interpolation of heterogeneous, analog cartography into a homogeneous digitally stored cadastral mapping. ESA

N86-31963# Army Engineer Topographic Labs., Fort Belvoir, Va.
CAPIR/DEM: A COLLECTION SYSTEM FOR GEOGRAPHICALLY BASED DIGITAL ELEVATION DATA

J. Hutchings, B. Kiracofe, G. Nash, H. Niedzwiadek, and Dan Edwards Dec. 1985 20 p
(AD-A167471; ETL-R-088) Avail: NTIS HC A02/MF A01 CSCL 08/2

Digital grid-point elevation models are a widely distributed and applied source of digital topographic data. DEMs are commonly used to generate planimetric contour, slope, or aspect maps and are often merged with other sources of data for sophisticated modeling and systems applications. DEMs cover either large land areas at a course resolution or very limited sites at high resolution. Emerging technology in such diverse areas as robotics, computer image generation, and computer simulation will require timely, cost effective custom DEM data. This paper details a system designed to meet these impending future requirements for DEM (Digital Elevation Models). A collection system for DEMs using an adaptive spacing grid is used to optimize resources when collecting DEMs in areas that have wide variations in relief. Future enhancements are proposed to provide adjustments between data collected during separate sessions and to densify existing DEM data to a higher resolution. GRA

N86-31964# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
INVESTIGATION OF POLAR MOTION FROM DOPPLER TRACKING OF THE NNSS (NAVY NAVIGATION SATELLITE SYSTEM) DURING THE MERIT CAMPAIGN Final Report
William H. Wooden, John A. Bangert, and J. M. Robinson Apr. 1986 18 p Presented at the 4th International Geodetic Symposium on Satellite Positioning, Austin, Tex., 23 Apr. - 2 May 1986
(AD-A167565) Avail: NTIS HC A02/MF A01 CSCL 03/1

For more than a dozen years, Doppler tracking of the Navy Navigation Satellite System (NNSS) has demonstrated the ability to give solutions for polar motion as a byproduct of precise ephemerides generation. This paper reviews the polar motion estimation process at the Defense Mapping Agency from Doppler measurements of the NNSS and gives comparisons to polar motion series from newer observational techniques and to the Bureau International del'Heure Circular-D series. The different techniques are compared for the period of the MERIT Main Campaign. In addition to comparing results for the Nova and Oscar NNSS satellites, comparisons are done utilizing the WGS 84 and the NWL 9Z2 gravitational fields in the precise ephemerides generation process. GRA

N86-31965# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
NORDA ARCTIC DATA COLLECTION, PROCESSING AND INTERPRETATION CAPABILITIES Final Report
Duane T. Eppler and Jeffrey D. Hawkins Sep. 1985 26 p
(AD-A167797; NORDA-129) Avail: NTIS HC A03/MF A01 CSCL 08/12

The Special Sensor Microwave/Imager (SSM/I) will provide the Navy with the global capability to measure sea ice, wind speed, water vapor, rain rate, and several other atmospheric parameters. The sea ice retrievals will go a long way toward filling a present gap in analysis data sets. Thus, proper validation of this sensor's abilities is required if the full potential is to be achieved. Naval Ocean Research and Development Activity (NORDA) personnel have access to a number of ground, aircraft, and spaceborne instruments that can contribute to SSM/I sea ice validation efforts. Ice camps, the K-band Radiometric Mapping System (KRMS), and satellite visible and infrared data can all provide a piece of the puzzle when addressing the issue of algorithm performance. It is essential to include ground, air, and spaceborne resources to tackle the task of validating the sea ice information retrieved from SSM/I data. Not only must we cover large geographic regions synoptically, but we must also be able to discern smaller irregularities found within the SSM/I cell footprints. Only then can we push algorithms to their required limits. GRA

N86-31966# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF MULTIPLE LINES OF POSITION FOR HYDROGRAPHY M.S. Thesis
Samuel P. DeBow, Jr. Mar. 1986 124 p
(AD-A167884) Avail: NTIS HC A06/MF A01 CSCL 17/7

Conventional near-shore large-scale hydrographic surveys use only two lines of position (LOPs) for position fixing. Previous works have proved that accuracies needed to meet the present International Hydrographic Organization standards are frequently not achieved using conventional surveying methods. The concept of using multiple lines of position (MLOP) adjusted by the least squares method was described. Actual field measurements acquired in the autumn of 1984 were processed to ascertain the increase in accuracy using MLOP versus conventional two LOPs on each hydrographic position. Recommendations are to use a four-range fully automated position-fixing method to increase production, improve data quality, and have better control of the survey operations. GRA

N86-31967# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.
THE USGS (US GEOLOGICAL SURVEY) X-, C-, AND L- BAND SAR DATA COLLECTION PROGRAM Topic Report, Nov. 1983 - Aug. 1985
Eric S. Kasischke Aug. 1985 121 p
(Contract DI-14-08-0001-21748)
(AD-A168173; ERIM-173000-4-T) Avail: NTIS HC A06/MF A01 CSCL 17/9

This report presents the results of data collection program performed for the U.S. Geological Survey. Twenty-two passes of high resolution (3m), multifrequency (X-, C- and L-band) and multipolarization (VV and VH) imagery were collected over five test sites within the North Carolina Digital Project Area. The SAR used for this program was the ERIM/CCRS CV-580 SAR System. This report presents diagrams of the ground swath of each SAR pass, along with representative SAR imagery which illustrates the high quality of the data set. The engineering assessment performed on the SAR imagery is discussed. The optical and digital SAR data products generated for this program are summarized, including the first-order geometric and radiometric corrections applied to the digital data. GRA

N86-31968# Geological Survey, Sioux Falls, S. Dak.
DIGITAL PROCESSING OF LANDSAT TM IMAGES FOR LINEAMENT OCCURRENCE AND SPATIAL FREQUENCY IN SEDIMENTARY ROCKS
G. K. Moore and D. A. Hastings 1986 33 p
(Contract DE-AI05-85OR-21552)
(DE86-009834; DOE/OR-21552/1) Avail: NTIS HC A03/MF A01

This report describes and evaluates procedures for the enhancement and extraction of lineament segments by computer processing of digital Landsat Thematic Mapper data. Nearly all results were obtained by convolution of filter windows in the spatial domain. During the course of the study several new procedures were developed for image enhancement, directional enhancement, and the extraction of edge and line segments from directionally-filtered images. The standard procedure proved satisfactory for an extraction of prominent edges and lines in the Landsat images. Part of the problem is caused by the landscape and illumination characteristics of the selected images, but another part is caused by the fact that many boundaries are gradational and do not fit a simple mathematical description of edges and lines. Because of this problem, extraced segments in shale outcrop areas were not compared with those in other types of sedimentary rocks, and measurements of the spatial frequency of occurrence of these segments have a questionable value. A possible solution to the problems found by this study would be: (1) to use a combination of digital elevation data and digital remotely-sensed data of the same area; and (2) to combine directional enhancement and lineament segment extraction with visual detection, screening, and editing. DOE

N86-31969# World Meteorological Organization, Geneva (Switzerland).
LEVEL AND DISCHARGE MEASUREMENTS UNDER DIFFICULT

CONDITIONS
O. A. Tilrem 1986 50 p
(WMO-650; ISBN-92-63-10650-9; ESA-86-97249) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland SWFR 7

The measurement of water levels and river discharge in unstable stream channels, flash floods, variable backwater, unsteady flow, bank overflow, large interchange between surface water groundwater, arid areas, and channels affected by tides, winds, ice, and aquatic growth is discussed. The hydrological cases which might occur; technical problems which may arise; and operational solutions to the problems are considered. Measurement methods applicable in these situations are tabulated. ESA

N86-31970# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
[ACTIVITIES REPORT IN REMOTE SENSING SUPERVISION] Annual Report, 1983 [JAARVERSLAG 1983]
1984 52 p In DUTCH
(ESA-86-97383) Avail: NTIS HC A04/MF A01

Remote sensing application to sea surface investigations (ship microwave radar systems for wave observation, spectrophotometry of surface water, and oil detection using multispectral scanners, laser fluoro sensors, and high frequency radar techniques); agriculture and nature protection (field spectrometer measurements to determine biomass, thermal images and false color photographs to determine the hydrological soil condition, detection of crop damage and illness caused by pollution and/or heat, and cadastral mapping); and town and country planning are discussed. Processing of remote sensing data is considered. ESA

N86-31971# European Space Agency, Paris (France).
CALIBRATION OF MULTISPECTRAL SCANNER (MSS) SATELLITE DATA TO EVALUATE CHANGE IN THE REFLECTION OF CONIFEROUS STOCKS
Gerd-Peter Fehlert Nov. 1985 180 p Original language document was announced as N86-10636
(ESA-TT-938; DFVLR-FB-84-44; ESA-86-97575) Avail: NTIS HC A09/MF A01; original German version available from DFVLR, Cologne, West Germany DM 71

A relative calibration was performed in order to allow a comparative, multitemporal analysis of MSS satellite data and hence the detection of reflectory changes with regard to selected object classes. By applying the method to the class wood, the age of a coniferous stock can be determined, and during the stage of growth distinct age groups show locally differing reflection properties. The latter suggests disorders of the proliferation of young sprouts. This method can be an early indicator for the detection of damaged forest areas. The atmospheric influence on satellite data was determined by a multilayer atmospheric model. ESA

N86-31972# Institut National Polytechnique, Toulouse (France).
INTEGRATION OF THE TOPOGRAPHY IN TELEDETECTION IMAGE DATA PROCESSING Ph.D. Thesis [INTEGRATION DU RELIEF AU TRAITEMENT D'IMAGES DE TELEDETECTION]
Catherine Proy 1986 188 p In FRENCH
(Contract ATP-84/CNES/1259)
(ESA-86-97652) Avail: NTIS HC A09/MF A01

A method of topographic data acquisition from charts and the analysis of the signal produced by a target in mountainous country are discussed. A simulation procedure was carried out and applied to two Pyrenees regions. In the processed data a better equilibrium of shadow and light is found. It is shown that additional corrections related to aerosols in the atmosphere and surface characteristics are necessary. ESA

N86-31973# Physics and Electronics Lab. TNO, The Hague (Netherlands).
MOISTURE DETERMINATIONS IN AND UNDER VEGETATION CANOPIES
G. P. deLoor Jul. 1985 50 p Sponsored by Dutch Remote Sensing Board
(FEL-1985-52; ESA-86-97770) Avail: NTIS HC A03/MF A01

Using the vegetation model of Attema and Ulaby (1978) the possibilities of moisture determinations in a canopy, and of the soil under it, with radars of different frequencies are investigated. The moisture determinations require lower frequencies (C-band and lower). Soil moisture and vegetation moisture determinations require different incidence angles (10 to 20 deg, and > 30 deg respectively). For frequencies in the X-band and higher, the canopy becomes opaque for the radar waves and the backscatter becomes dependent on the moisture distribution in the canopy (plant architecture). This makes classification (incidence angles 40 deg) easier and possibly also the detection of changes in plant architecture due to stress. ESA

N86-31974# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
IMAGE QUALITY CRITERIA WITH EMPHASIS ON CRITERIA FOR REMOTE SENSING IMAGERY
J. C. A. vanderLubbe 1 Mar. 1984 94 p Sponsored by Netherlands Agency for Aerospace Programs
(NLR-TR-84040-U; ESA-86-98034) Avail: NTIS HC A05/MF A01

A guide for the measurement of image quality is presented. Common approaches to image quality assessment plus less considered aspects of image quality texture and edge quality are treated. ESA

N86-31975# Rome Univ. (Italy). Dipt. di Fisica.
THE RESULTS OF HYDROLOGICAL MEASUREMENTS IN THE SOUTHERN ADRIATIC, THE WEST COAST OF SICILY AND THE VATICAN CAPE, PRELIMINARY REPORT [RAPPORTO PRELIMINARE SUI RISULTATI DELLE MISURE IDROLOGICHE NELL'ADRIATICO MERIDIONALE, NEL GOLFO DI TARANTO, AL LARGO DELLA COSTA ORIENTALE DELLA SICILIA E A CAPO VATICANO]
Francesco Bignami, Guido Didonfrancesco, Letizia Pampaloni, and Paola Sbriccoli 28 Mar. 1986 92 p In ITALIAN
(Preprint-502; ESA-86-97933) Avail: NTIS HC A05/MF A01

A hydrological campaign was carried out in order to study the deep waters of the Adriatic and Ionic seas. Satellite data indicating the presence of turbulence were to be verified. The vertical profiles of temperatures, salinity, and density were obtained. Ship position was estimated using the Loran C method. The instruments included echo sounding equipment and bathymeters. The detailed data is presented. ESA

N86-31976# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
[ACTIVITIES REPORT IN AEROSPACE SURVEY AND SPACE SCIENCES] Annual Report, 1984
1984 38 p
(ESA-86-98042) Avail: NTIS HC A04/MF A01

Education and research programs in photogrammetry, aerial photography and remote sensing, cartography, land resource surveys and rural development, Earth resources surveys, urban survey, and human settlement analysis are described. ESA

N86-31977# Wageningen Agricultural Univ. (Netherlands). Dept. of Soil Science and Geology.
INTRODUCTION TO THE INTERPRETATION OF REMOTE SENSING DATA
M. A. Mulders and D. Legger Jan. 1985 27 p
(ESA-86-98067) Avail: NTIS HC A03/MF A01

Aerial photography and other remote sensing techniques; true and false color photography; photointerpretation; map legends; and derivation of soil maps from aerial photointerpretation maps are introduced. ESA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-31978 Technische Hogeschool Twente, Enschede (Netherlands). Technology and Development Group.

PROSPECTS FOR SMALL AND MARGINAL FARMERS IN TRICHY DISTRICT (TAMIL NADU, INDIA) TO USE WATER PUMPING WINDMILLS FOR IRRIGATION

Peter Goedhart May 1984 136 p Sponsored by Humanistic Institute for Cooperation with Developing Countries
(ESA-86-97721) Avail: Issuing Activity

The economic, technical, and agricultural aspects of equiping poor farmers in India with windpowered pumps were analyzed. It is concluded that the prospects for a market for windmills among nontarget group farmers (especially big farmers with diesel pumps) are better than the prospects among the target group farmers. Continuation of the project might lead to an improvement of the situation for the richer farmers, which would in turn lead to a decline in the situation of the original target group of the project, the small and marginal farmers. ESA

N86-31979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PARAMETRIC AND CYCLE TESTS OF A 40-A-HR BIPOLAR NICKEL-HYDROGEN BATTERY

Robert L. Cataldo 1986 12 p Presented at the 21st Intersociety Energy Conversion Engineering Conference (IECEC), San Diego, Calif., 25-29 Aug. 1986; sponsored by ACS, SAE, ANS, ASME, IEEE, AIAA and AIChE
(NASA-TM-88793; E-3102; NAS 1.15:88793) Avail: NTIS HC A02/MF A01 CSCL 10C

A series of tests was performed to characterize battery performance relating to certain operating parameters which included charge current, discharge current, temperature and pressure. The parameters were varied to confirm battery design concepts and to determine optimal operating conditions. Spacecraft power requirements are constantly increasing. Special spacecraft such as the Space Station and platforms will require energy storage systems of 130 and 25 kWh, respectively. The complexity of these high power systems will demand high reliability, and reduced mass and volume. A system that uses batteries for storage will require a cell count in excess of 400 units. These cell units must then be assembled into several batteries with over 100 cells in a series connected string. In an attempt to simplify the construction of conventional cells and batteries, the NASA Lewis Research Center battery systems group initiated work on a nickel-hydrogen battery in a bipolar configuration in early 1981. Features of the battery with this bipolar construction show promise in improving both volumetric and gravimetric energy densities as well as thermal management. Bipolar construction allows cooling in closer proximity to the cell components, thus heat removal can be accomplished at a higher rejection temperature than conventional cell designs. Also, higher current densities are achievable because of low cell impedance. Lower cell impedance is achieved via current flow perpendicular to the electrode face, thus reducing voltage drops in the electrode grid and electrode terminals tabs. Author

N86-31980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF IMPREGNATION METHOD ON CYCLE LIFE OF THE NICKEL ELECTRODE

John J. Smithrick 1986 9 p Presented at the 21st Intersociety Energy Conversion Engineering Conference (IECEC), San Diego, Calif., 25-29 Aug. 1986; sponsored by ACS, SAE, ANS, ASME, IEEE, AIAA and AIChE
(NASA-TM-87326; E-3037; NAS 1.15:87326) Avail: NTIS HC A02/MF A01 CSCL 10C

The nickel electrode has been identified as the life limiting component for individual pressure vessel (IPV) nickel-hydrogen cells when cycled under a low earth orbit (LEO) cycle regime at deep depths of discharge. As a part of an overall program to develop a long life nickel electrode for nickel-hydrogen cells, the effect of two different methods of electrochemical impregnation on the cycle life of the nickel electrode was investigated. One method was the Pickett (aqueous/ethanolic) process. The other was the modified Bell (aqueous) process. The plaques for both impregnation methods were made by sintering dry carbonyl nickel powder in a reducing atmosphere. The plaques contain a nickel screen substrate. Electrodes made from both processes were cycle tested in Air Force design IPV nickel-hydrogen cells. The only factor different for this test was the method of plaque impregnation; all other factors were the same. The cells were cycled to failure under a 90 min LEO cycle regime at a deep depth of discharge (80 percent DOD). Failure for this test was defined to occur when the cell voltage degraded to 1.0 V prior to the completion of the 35 min discharge. Author

N86-31981*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN CONSIDERATIONS FOR ADVANCED BATTERY CONCEPTS

Harold F. Leibecki and Lawrence H. Thaller 1986 16 p Presented at the 3rd Space Systems Technology Conference, San Diego, Calif., 9-12 Jun. 1986; sponsored by the American Institute of Aeronautics and Astronautics Previously announced in IAA as A86-40579
(NASA-TM-87319; E-3055; NAS 1.15:87319) Avail: NTIS HC A02/MF A01 CSCL 10C

A mathematical representation for the charge and discharge of a sodium-sulfur cell is developed. These equations are then used as the basis for a computerized model to examine the effects of cell arrangement in the design of a large multi-kilowatt battery from a group of hypothetical individual cells with known variations in their ampere hour capacity and internal resistance. The cycling characteristics of 216 individual cells arranged in six different configurations are evaluated with the view towards minimizing the adverse effects that are introduced due to the stoichastic aspects of groupings of cells, as well as the possibility of cell failures in both the open and shorted mode. Although battery systems based on sodium-sulfur cells are described in this example, any of the newer electrochemical systems can be fitted into this framework by making appropriate modifications to the basic equations. Author

N86-31982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ESTIMATED HEATS OF FUSION OF FLUORIDE SALT MIXTURES SUITABLE FOR THERMAL ENERGY STORAGE APPLICATIONS

Ajay K. Misra (Case Western Reserve Univ., Cleveland, Ohio.) and John D. Whittenberger May 1986 26 p
(NASA-TM-87320; E-3057; NAS 1.15:87320) Avail: NTIS HC A03/MF A01 CSCL 10A

The heats of fusion of several fluoride salt mixtures with melting points greater than 973 K were estimated from a coupled analysis of the available thermodynamic data and phase diagrams. Simple binary eutectic systems with and without terminal solid solutions, binary eutectics with congruent melting intermediate phases, and ternary eutectic systems were considered. Several combinations of salts were identified, most notable the eutectics LiF-22CaF2 and NaF-60MgF2 which melt at 1039 and 1273 K respectively which posses relatively high heats of fusion/gm (greater than 0.7 kJ/g). Such systems would seemingly be ideal candidates for the light weight, high energy storage media required by the thermal energy storage unit in advanced solar dynamic power systems envisioned for the future space missions. M.G.

N86-31983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF NASA/DOE AILERON-CONTROL DEVELOPMENT PROGRAM FOR WIND TURBINES Final Report
Dean R. Miller 1986 26 p Presented at the Energy-Sources Technology Conference and Exhibition, New Orleans, La., 23-26 Feb. 1986; sponsored by American Society for Mechanical Engineers
(Contract DE-AI01-76ET-20320)
(NASA-TM-88811; DOE/NASA-20320/71; E-3163; NAS 1.15:88811) Avail: NTIS HC A03/MF A01 CSCL 10A

The development of aileron-control for wind turbines is discussed. Selected wind tunnel test results and full-scale rotor test results are presented for various types of ailerons. Finally, the current status of aileron-control development is discussed. Aileron-control was considered as a method of rotor control for use on wind turbines based on its potential to reduce rotor weight and cost. Following an initial feasibility study, a 20 percent chord aileron-control rotor was fabricated and tested on the NASA/DOE Mod-0 experimental wind turbine. Results from these tests indicated that the 20 percent chord ailerons regulated power and provided overspeed protection, but only over a very limited windspeed range. The next aileron-control rotor to be tested on the Mod-0 had 38 percent chord ailerons and test results showed these ailerons provided overspeed protection and power regulation over the Mod-0's entire operational windspeed range. Author

N86-31984*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
GAS COOLED FUEL CELL SYSTEMS TECHNOLOGY DEVELOPMENT Final Report, May 1983 - May 1984
J. M. Feret Aug. 1986 282 p
(Contracts DEN3-290; DE-AI01-80ET-17088)
(NASA-CR-175047; DOE/NASA/0290-02; NAS 1.26:175047; WAESD-TR-85-0030) Avail: NTIS HC A13/MF A01 CSCL 10A

The work performed during the Second Logical Unit of Work of a multi-year program designed to develop a phosphoric acid fuel cell (PAFC) for electric utility power plant application is discussed. The Second Logical Unit of Work, which covers the period May 14, 1983 through May 13, 1984, was funded by the U.S. Department of Energy, Office of Fossil Energy, Morgantown Energy Technology Center, and managed by the NASA Lewis Research Center. Author

N86-31985# Intersol Power Corp., Lakewood, Colo.
INSTALLATION OF A MODULAR BUILDING BLOCK PHOTOVOLTAIC CONCENTRATOR ARRAY FIELD
J. A. Sanders, D. C. Cass, and S. Broadbent Jun. 1985 81 p
(Contract DE-AC04-76DP-00789)
(DE85-016032; SAND-84-7022) Avail: NTIS HC A05/MF A01

A building block array field nominally rated at 25 kW has been installed in Albuquerque, New Mexico. The building block is a single source electrical circuit of six center pedestal two-axis tracking arrays connected in parallel and having a nominal operating voltage of 420 volts DC. Each array contains 60 point-focusing Fresnel lens photovoltaic concentrator modules connected in series for a nominal power output of 4.2 kW per array. The structural design uses a center pedestal two-axis cantilevered support tube with a closed loop sun sensor electronic control system. A master control provides manual override of the array field. The installation was accomplished without difficulty and demonstrated the ease of turnkey building block installation. The costs of 1 MW size fields is estimated to be $6.99 per watt installed based on the building block installation. Author

N86-31986# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PHOTOVOLTAICS: ELECTRICITY FROM SUNLIGHT, FY 1985 ACCOMPLISHMENTS
Mar. 1986 121 p
(Contract DE-AC02-83CH-10093)
(DE86-004429; SERI/SP-216-2890) Avail: NTIS HC A06/MF A01

This summary of FY 1985 accomplishments contains the technical highlights of SERI's program in photovoltaic research and development and a bibliography of technical publications. Also included are several management highlights. Selected accomplishments are categorized according to research tasks identified in the DOE National PV Program's Five-Year Research Plan. The DOE task areas appearing here are Single-Junction Thin Films, High-Efficiency Multijunction Concepts, Innovative Concepts, Flat-Plate Collectors, and System Experiments. Subcontract program categories include amorphous thin films, high-efficiency concepts, polycrystalline thin films, crystalline silicon, and innovative concepts, which are further subdivided into new ideas, the University Participation Program, and photoelectrochemical cells. SERI's internal PV task areas are PV Devices and Measurements, Solid State Research, Insolation Resource Assessment, Advanced PV Systems Research, and solar electric research activities. The bibliography is a compilation of the technical publications resulting from all of SERI's research during FY 1984 and FY 1985. The entries are listed alphabetically by author. DOE

N86-31987# Sanders Associates, Inc., Nashua, N. H. Defense and Information Systems Div.
PARABOLIC DISH MODULE EXPERIMENT Final Test Report
Mar. 1986 206 p
(Contract DE-AC04-76DP-00789)
(DE86-009819; SAND-85-7007) Avail: NTIS HC A10/MF A01

A development test model of the 8-meter Solar Brayton Parabolic Dish Module has been designed, fabricated, and tested. The test model consists of five major subsystems: Sanders ceramic honeycomb solar receiver; LaJet LEC460 solar concentrator; AiRsearch SABC MKIIIA engine, Abacus 8 kW ac inverter; and a Sanders designed and built system controller. Goals of the tests were to integrate subsystem components into a working module, demonstrate the concept, and generate 5 kWe (hybrid) and 4.7 kWe (solar only) input. All subsystem integration goals were successfully achieved, but system performance efficiency was lower than expected. Contributing causes of the lower performance efficiencies have been identified. Modifications needed to restore performance to the required levels and improve the system life cycle cost have been addressed and are the subject of this final report. DOE

N86-31988# Sandia National Labs., Albuquerque, N. Mex.
EVALUATION OF HELIOSTAT FIELD-RECEIVER CONFIGURATIONS
S. E. Faas and W. S. Winters Mar. 1986 75 p
(Contract DE-AC04-76DR-00789)
(DE86-009875; SAND-86-8007) Avail: NTIS HC A04/MF A01

This report evaluates and compares north heliostat field/cavity receiver configurations and surround heliostat field/external receiver configurations. The receiver coolants are molten nitrate salts and liquid sodium. Both field/receiver configurations use molten salt thermal storage; the sodium receiver is thermally connected to thermal storage by a sodium-to-salt heat exchanger. The heliostat field size is fixed at 1,000,000 square meters of reflective area, and the delivered molten salt temperature is fixed at 566 C. The delivered thermal power varies from 500 to 600 MW(sub t), depending on the overall system efficiency. The generic north heliostat field/cavity receiver configurations were found to be 6 to 10 percent efficient than a generic surround field/external receiver configuration. There was little or no difference found in the transient performance of a molten salt receiver compared to a sodium receiver connected to a sodium-to-salt heat exchanger. Four configurations were of particular interest: (1) a north heliostat field/single cavity molten salt receiver, (2) a surround heliostat field/external cylinder molten salt receiver, (3) a surround heliostat field/external cylinder liquid sodium receiver, and (4) a north heliostat field/single cavity liquid sodium receiver. It was found that the surround field/liquid sodium external receiver configuration may provide energy at a 14 percent lower levelized energy cost than a north field/molten salt cavity receiver configuration. However, the cost advantage of the surround field/liquid

sodium external receiver is not conclusive because of uncertainties in system component costs. DOE

N86-31989# Sandia National Labs., Albuquerque, N. Mex.
AEROELASTIC EFFECTS IN THE STRUCTURAL DYNAMIC ANALYSIS OF VERTICAL AXIS WIND TURBINES
D. W. Lobitz and T. D. Ashwill Apr. 1986 23 p
(Contract DE-AC04-76DP-00789)
(DE86-009542; SAND-85-0957) Avail: NTIS HC A02/MF A01

Aeroelastic effects impact the structural dynamic behavior of vertical axis wind turbines (VAWRs) in two major ways. First, the stability phenomena of flutter and divergence are direct results of the aeroelasticity of the structure. Secondly, aerodynamic damping can be important for predicting response levels, particularly near resonance, but also for off-resonance conditions. The inclusion of the aeroelasticity is carried out by modifying the damping and stiffness matrices in the NASTRAN finite element code. Through the use of a specially designed preprocessor, which reads the usual NASTRAN input deck and adds appropriate cards to it, the incorporation of the aeroelastic effects has been made relatively transparent to the user. NASTRAN flutter predictions are validated using field measurements and the effect of aerodynamic damping is demonstrated through an application to the Test Bed VAWT being designed at Sandia. DOE

N86-31990# National Bureau of Standards, Washington, D.C.
INORGANIC COMPOUNDS FOR PASSIVE SOLAR ENERGY STORAGE: SOLID-STATE DEHYDRATION MATERIALS AND HIGH SPECIFIC HEAT MATERIALS Progress Report
L. J. Struble and P. W. Brown Apr. 1986 69 p
(Contract DE-AI01-76PR-06010)
(DE86-010214; NBSIR-86-3325) Avail: NTIS HC A04/MF A01

Two classes of hydrated inorganic salts have been studied to assess their potential as materials for passive solar energy storage. The materials are part of the quaternary system CaO-Al2O3-SO3-H2O and related chemical systems, and the two classes are typified by ettringite, a trisubstituted salt, and Friedel's salt, a monosubstituted salt. The trisubstituted salts were studied for their possible application in latent heat storage, utilizing a low-temperature dehydration reaction, and both classes were studies for their application in sensible heat storage. In order to assess their potential for energy storage, the salts have been synthesized, characterized by several analytical techniques, and thermal properties measured. The dehydration data of that the trisubstituted salts vary somewhat with chemical composition, with the temperature of the onset of dehydration ranging from 6(0)C to 33(0)C, and enthalpy changes on dehydration ranging from 60 to 200 cal/g. Heat capacity is less variable with composition; values for the trisubstituted phases are 30 cal/g/(0)C and for the monosubstituted phases between 0.23 and 0.28 cal/g/(0)C. Preliminary experiments indicate that the dehydration is reversible, and suggest that the materials might have additional potential as solar desiccant materials. These thermal data demonstrate the trisubstituted salts have potential as latent heat storage materials, and that both classes of salts have potential as sensible heat storage materials. DOE

N86-31991# Los Alamos National Lab., N. Mex.
PROGRESS IN FUEL CELLS FOR TRANSPORTATION APPLICATIONS
H. S. Murray 1986 20 p Presented at the 3rd International Symposium on Hydrogen Produced from Renewable Energy, Manoa, Hawaii, 22 May 1986
(Contract W-7405-eng-36)
(DE86-010206; LA-UR-86-1476; CONF-8605109-1) Avail: NTIS HC A02/MF A01

The current and projected states of development of fuel cells are described in terms of availability, performance, and cost. The applicability of various fuel cell types to the transportation application is discussed, and projections of power densities, weights, and volumes of fuel cell systems are made into the early 1990s. Research currently being done to advance fuel cells for vehicular application is described. A summary of near-term design parameters for a fuel cell transit line is given, including bus performance requirements, fuel cell power plant configuration, and battery peaking requirements. The objective of this paper is to determine a fuel cell technology suitable for near-term use as a vehicular power plant. The emphasis of the study is on indirect methanol fuel cell systems. DOE

N86-31992# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
PHOTOVOLTAIC POWER SYSTEM DESIGN FOR TELECOMMUNICATIONS
Iain F. Garner 1985 9 p
(ESA-86-97255) Avail: NTIS HC A02/MF A01

The use of photovoltaic power systems for telecommunications, particularly in rural areas, is reviewed. Operating costs and maintenance are discussed. System design, including the collection of insolation data and the calculation of system capacity, is treated. Increasing reliability of photovoltaic modules and storage batteries is noted. The advantages of relay switching over solid state are outlined. Array mountings are described. ESA

N86-31993# Societe Nationale Industrielle Aerospatiale, Cannes (France). Dept. Generateurs Solaires.
PHOTOVOLTAIC SOLAR GENERATORS: FROM SATELLITES TO A SPACE STATION [LES GENERATEURS SOLAIRES PHOTOVOLTAIQUES: DU SATELLITE A LA STATION SPATIALE]
M. A. Ziliani 17 Feb. 1986 21 p In FRENCH
(SNIAS-861-440-112; ESA-86-97620) Avail: NTIS HC A02/MF A01

Ways to generate power for spacecraft operation are presented and the design of a 30 kW solar generator for the Columbus platform is described. The generator is specified for 10 yr life, 30 kW continuous power, low atmospheric drag, H shape deployment and 1992 launching target. A GaAs option is included, as the anticipated performance is better that of silicon cells. It is shown that the generator design is characterized by high reliability, low cost, and good adaptability (15 to 60 kW). ESA

N86-31994# Technische Hogeschool, Delft (Netherlands). Inst. for Wind Energy.
ROTOR AERODYNAMICS OF HORIZONTAL AXIS WIND TURBINES. SUMMARY OF LECTURES AND DISCUSSIONS. PRESENTATION OF RESULTS OF CALCULATION METHODS [ROTORAERODYNAMICA VAN HORIZONTALE-AS WINDTURBINES NEWIN-WORKSHOP D.D. 16-4-1985. SAMENVATTING VAN DE LEZINGEN EN DISCUSSIES. PRESENTATIE VAN RESULTATEN UIT BEREKENINGSMETHODEN]
G. J. W. vanBussel and G. A. M. vanKuik Sep. 1985 39 p In DUTCH Proceedings of NEWIN Workshop, Delft, Netherlands, 4 Apr. 1985
(THD-IW-R505; THE-R-738-D; ESA-86-97706) Avail: NTIS HC A03/MF A01

Models for the calculation of the aerodynamic performances of horizontal-axis wind turbines under uniform straight flow were evaluated. The axial momentum theory was revised. The blade-element momentum method PHATAS and its Viterna-Corrigan correction are presented. The lifting line methods PREDICHAT and HELIX are explained. The results of the calculation methods for a reference rotor configuration were compared with measurements. Large discrepancies between the methods are found. Theory and experiment differ too much to allow a reliable prediction of the performance of designs. The measurements were not good enough for a correct evaluation of the theoretical models. The very large deviations of the results of PHATAS compared to other methods cannot be explained. ESA

N86-31995# Technische Hogeschool, Delft (Netherlands). Vakgroep Elektriciteitsvoorziening.
OPTICAL POWER FLOW WITH SEQUENTIAL QUADRATIC PROGRAMMING [OPTIMAL POWER FLOW MET SEQUENTIAL QUADRATIC PROGRAMMING]
R. A. M. vanAmerongen 31 Jan. 1985 75 p In DUTCH

(ESA-86-97708) Avail: NTIS HC A04/MF A01

Newton's method as an approach to solve the optimal power flow problem in electric power plants is presented. A general formulation of the optimal flow problem is given. Newton's method is applied to solve the nonlinear Kuhn-Tucker conditions by iteration. Every Newton step is calculated by solving a quadratic programming problem. Variations of the sequential quadratic programming method are presented. Byproducts of the optimization, namely the Lagrange multipliers and their interpretation as marginal costs and shadow prices, are outlined. The most important computer programs are enclosed. ESA

N86-31996# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. des Systemes Balistiques et Spatiaux.

LOW FREQUENCY NOISE AS A CONTROL TEST FOR SPACE SOLAR PANELS

B. Crsal, R. Alabedra, and R. Ruas 1986 25 p (SNIAS-861-440-109; ESA-86-97617) Avail: NTIS HC A02/MF A01

The use of low frequency noise as a nondestructive test of forward biased solar panels is studied. It is shown that by this method one cell with a given defect can be detected in a solar panel under dark condition. The theoretical analysis indicates that the electrical cell characteristics I-V are unchanged when a small defect is introduced while the noise of the cell with a defect is 10 to 15 times higher than that of a good cell. Experiments with a 5 x 5 panel shows that when a good cell is replaced with another with a defect the overall panel noise response increases by 30%. ESA

N86-31997# Societe Nationale Industrielle Aerospatiale, Cannes (France).

HIGH POWER RIGID SOLAR ARRAY

Marcel A. Ziliani and Lionel Pelenc 1986 7 p (SNIAS-861-440-110; ESA-86-97618) Avail: NTIS HC A02/MF A01

The design of a solar array providing 30 kW is described. Main specifications are compatibility with the European Columbus platform and resource module, low life cycle cost, reliability, multideployment-retraction ability and low development risk. The design is based on interchangeable rigid panels with silicon cells and proved pantograph mechanisms. The advantages of this concept include modularity at elementary panel (0.5 kW) level, capability of providing power while partially retracted, and of withstanding high levels of in-orbit loads. ESA

N86-31998# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.

HIGH POWER SOLAR ARRAY (HPSA) STUDY Final Report

G. J. Hegemans Paris ESA Jun. 1985 110 p (Contract ESTEC-6063/84-NL-PB(SC)) (Fok-TR-R-85-068; ESA-CR(P)-2182; ESA-86-97795) Avail: NTIS HC A06/MF A01

The design of a 30 kW planar Si-cell solar array for space shuttle payloads along with a GaAs-concentrator array are presented. Both arrays consist of blankets supported by a central, coplanar telescopic mast. Analysis results describing the array performances are summarized. A design and development philosophy is presented, critical design areas are pinpointed, and descoping/growth capability, orbital replacement units, and extravehicular servicing are discussed. ESA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-31999# Sandia National Labs., Albuquerque, N. Mex.

BALLOON TRACER FOR ATMOSPHERIC POLLUTANTS

E. W. Lichfield, M. D. Ivey, B. D. Zak, and H. W. Church 1985 11 p Presented at the ARGOS Users Conference, New Orleans, La., 23 Sep. 1985 Prepared in cooperation with Technadyne Engineering Consultants, Albuquerque, N. Mex. and Telemetrics Southwest, Alguquerque, N. Mex. (Contract DE-AC04-76DP-00789) (DE86-007144; SAND-86-0221C; CONF-8509254-1) Avail: NTIS HC A02/MF A01

An operational prototype of the Balloon Tracer was developed and described. This prototype was designed to be capable of meeting all of the desired specifications for the Balloon Tracer. Its buoyancy adjustment subsystem is shown. Three Gillian instrument pumps operating in parallel provide a flow of about 12 liters per minute, depending upon backpressure. The miniature Klippard mechanical valves are actuated by a servo mechanism which only requires power when the state of the valves is being changed. The balloon itself for the operational prototype is just under 3 meters in diameter. A block diagram of the operational prototype payload measures ambient pressure, temperature, and humidity obtained from AIR which outputs its data in ASCII format. The vertical anemometerhas a measured starting speed of under 2 cm/s, which has a Gill styrofoam propeller and a Spaulding Instruments rotation sendor. The command decoder is built around a chip developed originaly for remote control television tuners. The command receiver operating on 13.8935 MHz was developed and built by Hock Enginffering. The Argos transmitter is a Tectonic platform transmitter. The heart of the control both random access both and read only memory. DOE

N86-32000# Oak Ridge National Lab., Tenn.

APPLICATION OF A GEOGRAPHIC INFORMATION SYSTEM IN THE STUDY OF ACIDIC DEPOSITION

R. J. Olson 22 Jan. 1986 18 p Presented at the Geographic Information Systems for Environmental Protection, Las Vegas, Nev., 22 Jan. 1986 (Contract DE-AC05-84OR-21400) (DE86-008220; CONF-860161-1) Avail: NTIS HC A02/MF A01

The Oak Ridge National Laboratory (ORNL) Geographic Information System (GIS) is a primary tool for data base management, analysis, and graphic display in the assessment of acidic deposition effects on aquatic resources in the Adirondack Mountains of New York State. Functions of the ORNL GIS include: (1) data input and digitizing; (2) data transformation and manipulation; (3) data management and extraction; (4) integration and analysis; and (5) output and display. The GIS utilized watershed units, defined by digitizing boundaries drawn on large-scale topographic maps, to serve as common spatial units for integrating over 200 thematic variables for 463 headwater lakes. Many of the thematic variables used in the assessment involved manipulating several spatial data sets with specific algorithms to calculate levels of stress or natural conditions that could affect the aquatic resources. For example, precipitation amount and pollutant ionic concentrations were merged to estimate deposition values for each lake. Central to the GIS work is a data base management and statistical package to use with the thematic data base to develop multiple linear regression models for lake pH and alkalinity with watershed variables. Communication of the results of the assessment with computer-generated maps facilitated the understanding of complex spatial patterns. DOE

N86-32001# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Strahlenschutz.

ENVIRONMENTAL GAMMA RADIATION MONITORING SYSTEM WITH A LARGE VOLUME AIR IONIZATION CHAMBER

Klaus E. Duftschmid, Christian Strachotinsky, and Josef Witzani Jan. 1986 10 p Presented at Hungarian-Austrian-Yugoslavian Health Physicists Meeting on Computer Aided Methods in Radiation Protection, Budapest, Hungary, 22-25 Oct. 1985 (OEFZS-4344; ST-136/86; ESA-86-97246) Avail: NTIS HC A02/MF A01

An envionmental monitoring system consisting of an ionization chamber with 120l sensitive volume, operated at atmospheric pressure, and a commercial electrometer amplifier with digital voltmeter were designed and built. The system is controlled by a desk calculator with printer for automated operation and calculation of dose and dose rate. The ionization chamber provides superior

dosimetric performance as compared to usual Geiger counters and high pressure chambers. The system was field-tested during the European Intercomparison Program for Environmental Monitoring Instruments. ESA

N86-32002# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
INVESTIVATIONS OF DEPTH-RESOLVED LASER REMOTE MEASUREMENT OF NO2 AND SO2 IN THE VISIBLE AND UV SPECTRAL DOMAINS Thesis - Hamburg Univ. [UNTERSUCHUNGEN ZUR ORTSAUFLOESENDEN LASER-FERNMESSUNG VON NO2 UND SO2 IM SICHTBAREN UND ULTRAVIOLETTEN SPEKTRALBEREICH]
W. Staehr 28 Aug. 1985 126 p In GERMAN; ENGLISH summary
(GKSS-85/E/48; ISSN-0344-9629; ESA-86-97407) Avail: NTIS HC A07/MF A01

A lidar system was used for the depth-resolved remote measurement of the gaseous atmospheric polluants NO2 and SO2 by the differential absorption and scattering technique. The system was used to measure atmospheric extinction and backscattering coefficients under varying visibility conditions. The results of a detailed analysis of statistical and systematic errors of the trace gas detection were confirmed by experiment. For NO2 the sentitivity and data range are 10 ppb and 6 km, respectively; for SO2 15 ppb and 3 km. Field tests demonstrate the capabilities of the system to monitor ambient level concentrations as well as to determine quantitatively emissions from individual sources. ESA

N86-32003# Gesamthochschule, Wuppertal (West Germany). Fachbereich 8 - Physik.
AN ANALYSIS OF MEASUREMENTS OF ATMOSPHERIC TRACE GAS INFRARED EMISSIONS Final Report, Oct. 1984
Klaus Ulrich Grossmann, Peter Barthol, Wolfgang Frings, Reiner Hennig, and Dirk Offermann Bonn, West Germany BMFT Dec. 1985 144 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-016; ISSN-0170-1339; ESA-86-97460) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 30.50

The results of rocket-launched experiments in the mesosphere and the thermosphere to measure CO2, O3, H2O and O(3p) infrared emissions using liquid helium cooled spectrometers aboard Skylark 7 during the Energy Budget Campaign 1980/81 are compared to predictions. A computer program was developed to solve the radiation transport equation and is used to determine mesospheric temperature profiles, ozone, and water vapor density. Ozone varies in winter at high altitudes by + or - 30%. Anticorrelation in ozone and water vapor profiles in the mesosphere is noted. The water vapor distribution is inhomogeneous vertically and horizontally. Measurements of atomic oxygen fine structure radiation at 63 microns are compared to model calculations and show a consistent image due to reduced atomic transition or to reduced impact excitation cross sections. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-32004 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ATMOSPHERIC MOLECULES
C. Muller 1985 39 p Presented at International Center for Theoretical Physics Session, Trieste, Italy, 21 Jan - 22 Mar. 1985 (Aeronomica-Acta-F-38-1985; ESA-86-97485) Avail: Issuing Activity

The relevance of molecular physics to atmospheric physics is discussed. The composition and formation and physical properties of the Earth's atmosphere are explained. Penetration of solar radiation is considered. Infrared spectroscopy of the atmosphere is introduced. Observation techniques are outlined. ESA

N86-32005*# Little (Arthur D.), Inc., Cambridge, Mass.
SYSTEM STUDY OF THE UTILIZATION OF SPACE FOR CARBON DIOXIDE RESEARCH
Peter E. Glaser and Robert Vranka Oct. 1985 526 p
(Contract NAS8-35357)
(NASA-CR-3923; NAS 1.26:3923) Avail: NTIS HC A23/MF A01 CSCL 04A

The objectives included: compiling and selecting the Scientific Data Requirements (SDRs) pertinent to the CO2 Research Program that have the potential to be more successfully achieved by utilizing space-based sensor systems; assessment of potential space technology in monitoring those parameters which may be important first indicators of climate change due to increasing atmospheric CO2, including the behavior of the West Antarctic ice sheet; and determine the potential of space technology for monitoring those parameters to improve understanding of the coupling between CO2 and cloud cover. For individual titles, see N86-32006 through N86-32010.

N86-32006*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE SYSTEMS REQUIREMENTS DEFINITION **c47**
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 p 112 (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 04B

The compilation of Scientific Data Requirements (SDRs) were based on discussions with a representative cross section of the scientific community and a selected survey of the extensive literature dealing with the measurement of CO2-induced climatic changes. This approach resulted in a baseline set of SDRs to determine what could be accomplished with space-based sensors. Twenty-three SDRs emerged as the basis for the investigation of space systems. B.G.

N86-32007*# Little (Arthur D.), Inc., Cambridge, Mass.
SCIENTIFIC DATA REQUIREMENTS
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 50 p (For primary document see N86-32005 23-46)
(ADL-C-89230) Avail: NTIS HC A23/MF A01 CSCL 04A

Each Scientific Data Requirement (SDR) is summarized in terms of professional discipline, research program, technical description, related parameters, geographical extent, resolution, error tolerance, space-based sensors systems, personnel, implementation expert, notes, and references. B.G.

N86-32008*# Little (Arthur D.), Inc., Cambridge, Mass.
MEASURES OF MEASUREMENT ADEQUACY **c64**
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 14 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 12A

The adequacy of a measurement instrument is often characterized in terms of the precision, accuracy, and confidence that can be assigned to the measurements that it produces. The accuracy of the measurement may be defined as the size of the difference between the true and measured values. The precision of the system over a large number of measurements may be defined in terms of the sample standarad deviation. The confidence in an interval-values measurement may be defined as the probability that this interval contains the true value. These concepts are discussed in terms of their mathematical solutions. B.G.

N86-32009*# Little (Arthur D.), Inc., Cambridge, Mass.
A PROCEDURE FOR SPACE SDR PRIORITIZATION **c47**
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 12 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 04B

It was first necessary to arrive at a common set of attributes

which described the relative importance of each Scientific Data Requirement (SDR) to the DOE CO2 Research Program. Many attributes were considered. Some were rejected because they related more to engineering considerations than to scientific ones. Finally four were selected: importance for early detection of CO2-induced effects; need for additional measurements; importance for model inputs; and importance for model outputs. Each SDR was scored on these attributes. These scores were categorical (for example, low, medium, and high) and formed the basis for assigning a relative value to each SDR. For this ranking a methodology based on dominance theory was used. The methodology and the selected SDRs are discussed. Author

N86-32010*# Ball Aerospace Systems Div., Boulder, Colo.
SUBSYSTEM FACT SHEETS FOR NASA CO2 PROJECT, REVISION 3 **c19**
Tom Lookabaugh *In* Little (Arthur D.), Inc. System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 212 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 14B

The twenty-seven subsystem fact sheets produced by Ball Aerospace Systems Division are presented. Each instrument is summarized with a description; physical characteristics; data; orbit requirements; sensor; implementation schedule; and experience, problems, modifications. B.G.

N86-32011*# Old Dominion Univ., Norfolk, Va. Dept. of Geology.
THEORY AND OPERATION OF THE GOULD 32/27 PROGRAMS ABLE-2A AND EBLE FOR THE TROPOSPHERIC AIR MOTION MEASUREMENT SYSTEM Final Report, 1 Jan. - 31 Dec. 1985
Carolyn Butler Jun. 1986 102 p
(Contract NCC1-28)
(NASA-CR-176856; NAS 1.26:176856; GSTR-86-3) Avail: NTIS HC A06/MF A01 CSCL 04A

Software development for the Trospheric Air Motion Measurement Systems (TAMMS) is documented. In July/August the TAMMS was flown on the NASA/Goddard Flight Center Electra aircraft for 19 mission for the ABLE-2A (Amazon Boundary Layer Experiment) in Brazil. In December 1985, several flights were performed to assess the contamination and boundary layer of the Electra. Position data, flow angles, pressure transducer measurements were recorded. The programs written for the ABLE-2A were modified due to timing considerations for this particular program. The 3-step programs written for EBLE (Electra Boundary Layer Experiment) are described. Power up and log-on procedures are discussed. A few editing techniques are described for modification of the programs. B.G.

N86-32012*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTRAPLATE DEFORMATION DUE TO CONTINENTAL COLLISIONS: A NUMERICAL STUDY OF DEFORMATION IN A THIN VISCOUS SHEET
Steven C. Cohen and Richard C. Morgan Oct. 1985 27 p
(NASA-TM-86235; Rept-86B0019; NAS 1.15:86235) Avail: NTIS HC A03/MF A01 CSCL 08E

A model of crustal deformation from continental collision that involves the penetration of a rigid punch into a deformable sheet is investigated. A linear viscous flow law is used to compute the magnitude and rate of change of crustal thickness, the velocity of mass points, strain rates and their principal axes, modes of deformation, areal changes, and stress. In general, a free lateral boundary reduces the magnitude of changes in crustal thickening by allowing material to more readily escape the advancing punch. The shearing that occurs diagonally in front of the punch terminates in compression or extension depending on whether the lateral boundary is fixed or free. When the ratio of the diameter of the punch to that of the sheet exceeds one-third, the deformation is insenstive to the choice of lateral boundary conditions. When the punch is rigid with sharply defined edges, deformation is concentrated near the punch corners. With non-rigid punches, shearing results in deformation being concentrated near the center of the punch. Variations with respect to linearity and nonlinearity of flow are discussed. Author

N86-32013# SRI International Corp., Menlo Park, Calif.
MODEL FOR THE STEADY-STATE ROTATIONAL STIMULATED RAMAN GAIN COEFFICIENTS IN THE ATMOSPHERE
G. C. Herring, William K. Bischel, M. J. Dyer, and D. L. Huestis 21 Apr. 1986 78 p
(Contract N00014-84-C-0256)
(AD-A167469; SRI-MP-85-217; TR-1) Avail: NTIS HC A05/MF A01 CSCL 07/4

A model for stimulated Raman scattering in the atmosphere is described for the pure rotational transitions in N2. An empirical formula for the wavelength dependence of the Molecular Nitrogen polarizability anisotropy is derived from published measurements. The temperature and density dependence of the Raman linewidths were also measured in the laboratory. These results were then used to calculate the steady-state, plane wave Raman gain coefficient over the lower 100 km of the atmosphere. At sea level, the strongest lines have gain coefficients of 0.7 cc/km-MW for a Stokes laser wavelength of 350 nm. GRA

N86-32014# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF THE ATMOSPHERIC AEROSOL DISTRIBUTION BY MULTI-CHANNEL REMOTE SENSING TECHNIQUES M.S. Thesis
Scott R. Bulfinch Mar. 1986 88 p
(AD-A167885) Avail: NTIS HC A05/MF A01 CSCL 04/1

A simple image processing technique applied to channel 1 and channel 2 of the NOAA AVHRR sensor may be used to discern variations in aerosol particle size distribution. Ratios of the channel 1 albedo to the channel 2 albedo are calculated and displayed as an image. High ratio values are shown to indicate increased levels of submicron aerosols, while low ratio values indicate increased levels of supermicron aerosols. Horizontal variations in aerosol distributions may be observed directly by noting variations in ratio values, and vertical distributions may be inferred through the application of appropriate regional models of aerosol transport. A model of offshore advection of urban particles within the marine boundary layer is presented. Interpreting ratio values in light of this model, the offshore transport of urban aerosol particles is observed in AVHRR imagery of Sourthern California during the period 17-25 October 1984. Author (GRA)

N86-32015# SRI International Corp., Menlo Park, Calif.
THE SRI IONOSPHERIC STRUCTURE AND DYNAMICS PROGRAM, 1985 RESULTS Technical Report, 3 Jan. 1983 - 29 Jun. 1985
James F. Vickrey, Robert C. Livingston, Roland T. Tsunoda, Charles L. Rino, and Nancy B. Walker 30 Jun. 1985 219 p
(Contract DNA001-83-C-0034; DNA Proj. I25-AMXI)
(AD-A168115; DNA-TR-85-85) Avail: NTIS HC A10/MF A01 CSCL 20/14

This report describes recent observations of high latitude ionospheric structure and dynamics from the HILAT satellite and the Sondrestrom and EISCAT incoherent scatter radars. Plasma turbulence theory and ionospheric plasma diffusion processes are also described. Measured variations in latitude and local time of total electron content, levels of radio wave scintillation, and magnetospheric electrodynamics are presented for the northern polar regions. Seasonal and solar cycle variations of these phenomena are examined. Magnetic flux tube interchange produced by magnetospheric electrostatic turbulence (rather than local instability polarization fields) is suggested as an important source of high latitude ionospheric structure. The large scale magnetospheric potential field is also shown to be capable of steepening and structuring plasma gradients. These processes would certainly structure late time nuclear produced plasma. GRA

N86-32016# Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen (West Germany).
BALANCE OF THE TROPOSPHERIC OZONE AND ITS RELATION TO STRATOSPHERIC INTRUSIONS INDICATED BY

COSMOGENIC RADIONUCLIDES, PART 13 Annual Report, 1 Feb. 1982 - 31 Jan. 1983
R. Reiter, H. J. Kanter, H. Jaeger, and K. Munzert Jun. 1985 118 p
(Contract DE-AC02-76EV-03425)
(DE85-015560; DOE/EV-03425/27-Pt-13) Avail: NTIS HC A06/MF A01

The results of the statistical evaluation of the recording series of the tropospheric ozone concentrations in the air obtained at 3 different levels are presented. Data from the period 1977 to 1984 have been examined for this purpose. The mean annual variation of the ozone concentration and interannual variations are discussed. Using the annual means, it is attempted to make a trend analysis. To clarify the climatology of the stratospheric exchange, the measuring series of cosmogenic radionuclide Be-7, P-32, P-33 covering the period 1970 through 1981 are statistically analyzed with regard to the ozone concentration recorded on the Zugspitze. The statistics of stratospheric intrusions are shown and the stratospheric residence time is estimated. Effects of the eruption of volcano El Chichon in April 1982 on the concentration of the stratospheric aerosol are documented. The time variation of the concentration of the stratospheric aerosol is studied with consideration of the stratospheric circulation. The noted effects are weighted by a comparison with earlier volcanic eruptions. Author

N86-32017# Los Alamos National Lab., N. Mex.
E-LAYER IONOSPHERIC DISTURBANCES FOLLOWING THE COALINGA EARTHQUAKE
T. J. Fitzgerald and J. H. Wolcott Nov. 1985 39 p
(Contract W-7405-eng-36)
(DE86-008588; LA-10607-MS) Avail: NTIS HC A03/MF A01

A bistatic HF Doppler network in California recorded ionospheric disturbances after the Coalinga, California, earthquake of May 2, 1983. The ionospheric disturbances appear to be associated with acoustic waves launched vertically into the atmosphere from the ground motion caused by radially propagating surface seismic (Rayleigh) waves. The ionospheric disturbances were detected by variations in the frequency of the received transmissions (Doppler shifts); such disturbances have been observed in association with a number of previous earthquakes. The Doppler shifts were caused by phase path changes induced by the motion of the neutral atmosphere at the reflection height of the radio wave (200 km). We have also detected changes in the spectrum of the received transmissions following the Coalinga earthquake at the time of the passage of the acoustic waves through the E-layer. We interpret these spectral changes as an indication of specular reflection of the radio waves from index of refraction gradients induced by the acoustic waves, which have undergone significant nonlinear steepening during their propagation to 100 km. Since the acoustic waves were propagating upwards, the reflections had negative Doppler shifts. DOE

N86-32018# Los Alamos National Lab., N. Mex.
HOSTILE ENERGETIC PARTICLE RADIATION ENVIRONMENTS IN EARTH'S OUTER MAGNETOSPHERE
D. N. Baker, R. D. Belian, P. R. Higbie, R. W. Klebesadel, and J. B. Blake 1986 15 p Presented at the AGARD Symposium, Hague, Netherlands, 2 Jun. 1986 Prepared in cooperation with Aerospace Corp., El Segundo, Calif.
(Contract W-7405-eng-36)
(DE86-008752; LA-UR-86-1011; CONF-8606108-1) Avail: NTIS HC A02/MF A01

Many spacecraft operational problems in Earth's outer magnetosphere appear to be due to intense, transient radiation phenomena. Three types of naturally-occurring, and highly variable, hostile particle radiation environments are encountered at, or near, the geostationary orbit: (1) high-energy protons due to solar flares; (2) energetic ions and electrons produced by magnetospheric substorms; and (3) very high energy electrons of uncertain origin. Present particle sensor systems provide energetic particle detection and assessment capabilities during these kinds of high-energy radiation events. In this paper, particular emphasis is given to highly relativistic electrons (3 approx. 10 MeV). Electron fluxes and energy spectra are shown which were measured by two high-energy electron sensor systems at 6.6 R sub E from 1979 through 1984. Large, persistent increases in this population were found to be relatively infrequent and sporadic in 1979-81 around solar maximum. During the approach to solar minimum (1981 to present) it is observed that the highly relativistic electrons occur with a regular 27-day periodicity, and are well associated with the re-established solar wind stream structures. The present analysis suggests that the Jovian magnetosphere is a recurrent source of this significant electron population in the outer terrestrial magnetosphere and that these electrons have a very deleterious influence on spacecraft systems due to deep dielectric charging and low-dose susceptibility effects. DOE

N86-32019# Sandia National Labs., Albuquerque, N. Mex.
ESTIMATES OF AVAILABLE SOLAR RADIATION AND PHOTOVOLTAIC ENERGY PRODUCTION FOR VARIOUS TILTED AND TRACKING SURFACES THROUGHOUT THE US BASED ON PVFORM, A COMPUTERIZED PERFORMANCE MODEL
D. F. Menicucci and J. P. Fernandez Mar. 1986 97 p Prepared in cooperation with New Mexico Univ., Albuquerque
(Contract DE-AC04-76DP-00789)
(DE86-009549; SAND-85-2775) Avail: NTIS HC A05/MF A01

An improved photovoltaic performance model called PVFORM has been developed at Sandia National Laboratories. This new model incorporates the latest improvements in solar modelling techniques including the Perez anisotropic solar diffuse model. The PVFORM model has been used to produce tables of average solar radiation availabilities and corresponding direct current energy performance for a photovoltaic module mounted in various tilted and tracking configurations. Solar availabilities are also computed for some vertical and 45 deg. tilted wall surfaces for use in passive solar design. The tables contain average daily solar availabilities and PV energy production for 38 sites throughout the US. Each table contains four average daily values representing the four seasons of the year along with an annual average. Typical weather conditions are also presented for each of the 38 sites. This new model and the set of tables presented in this report are of special importance to solar energy system designers because they provide more accurate estimates of insolation availability on fixed and tracking surfaces by as much as 20%, PVFORM has been shown to be accurate to within 5% to 7% with no observable prediction bias. Use of the PVFORM model or the tabulated data found in this report will enable the architect or engineer to design more cost effective solar energy systems. DOE

N86-32020# Oregon Univ., Eugene. Solar Monitoring Lab.
PACIFIC NORTHWEST SOLAR RADIATION DATA
1 Apr. 1986 264 p
(Contract DE-AC79-81BP-24574)
(DE86-009635; DOE/BP-24574/2) Avail: NTIS HC A12/MF A01

The University of Oregon (UO) Solar Monitoring Laboratory has been making solar radiation measurements since 1975. Principal support for this work comes from the Bonneville Power Administration (BPA), along with the Eugene Water and Electric Board (EWEB) for the Eugene station, Washington Water Power (through a subcontract from the University of Idaho) for the Coeur d'Alene site and Pacific Power and Light (PP and L) for the Hood River site. This booklet is the final solar radiation report published under the auspices of BPA and contains all data gathered through December 31, 1985. Discussion of the data handling procedures and the accuracy of the data are included in the overview of the solar radiation network at the beginning of this booklet. A summary of the data follows in the form of monthly averaged and long term hourly averaged tables for each site. A comprehensive listing of the daily data is given at the end of the book. Hourly data for all direct monitoring sites are available from BPA except for Eugene, Coeur d'Alene, and Hood River. The hourly Eugene data are available from the University of Idaho. Fifteen minute Hood River data are available from PP and L. DOE

N86-32021# Ohmstede (William D.), Las Cruces, N. Mex.
CONTRIBUTIONS TO LARGE-EDDY SIMULATION, PART 1
W. D. Ohmstede Dec. 1985 29 p
(Contract W-7405-eng-48)
(DE86-009710; UCRL-15755-Pt-1) Avail: NTIS HC A03/MF A01

The purpose of this report is to bring to a close the contributions in support of the Large-Eddy Simulation (LES) project. Major progress has been made. The report UCRL-92457 entitled Planetary Boundary Layer Structure Derived from Large-Eddy Simulation for Benchmark Stability Categories (Cederwall, et al (1985)), and the presentation of this material at the Seventh Symposium on Turbulence and Diffusion, 12-15 November 1985 at Boulder, Colorado, constitute completion of major milestones. This report now looks to the future and recommends the next actions which should be taken to promote orderly progress within the project. DOE

N86-32022# Chalmers Univ. of Technology, Goeteborg (Sweden). Research Lab. of Electronics.
SATELLITE-EARTH RANGE MEASUREMENTS. PART 1: CORRECTION OF THE EXCESS PATH LENGTH DUE TO ATMOSPHERIC WATER VAPOR BY GROUND BASED MICROWAVE RADIOMETRY
Gunnar Elgered, Bernt Roennaeng, Erik Winberg, and Jan Askne Paris ESA Apr. 1985 115 p
(Contract ESTEC-5910/84-NL-MD)
(CTH-RR-147-Pt-1; ESA-CR(P)-2176-Pt-1; ESA-86-97221) Avail: NTIS HC A06/MF A01

The excess delay of radio waves penetrating the neutral atmosphere of the Earth, especially the delay due to water vapor, is discussed. The state of the art of sounding techniques and instrumentation, in particular microwave radiometry is reviewed. The physical background of the water vapor radiometer (WVR) method is presented and seven types of WVR are described. The expected accuracies of wet path delays vary with the local climate as well as with instrumental errors and the operating frequencies of the WVR. It is shown that errors in the wet path delay for zenith observations range from 0.4 to 0.9 cm rms for optimum WVR frequencies and instrumental errors of 0.5 K rms. Two WVR designs, one with high accuracy and one with low cost (but less accurate) are proposed for the ESA POPSAT system. ESA

N86-32023# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SOUNDING ROCKET PROGRAM MAGNETOSPHERE PAYLOAD CAESAR. REPORT ON SYSTEMS DEVELOPMENT, INTEGRATION, TESTING AND FLIGHT Final Report, Jul. 1985
Walter Schrieder and Walter Schnattinger Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1985 155 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-023; ISSN-0170-1339; ESA-86-97467) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 32

Experiments in the payload CAESAR aboard sounding rockets were carried out to determine the interactions between the magnetosphere and the ionospheric plasma during dawn arc phenomena and to study the energy transfer from the magnetosphere to the ionosphere and the related transformation processes. The field and ion distributions within and in the vicinity of a dawn arc and the arc formation are studied. The pulsative dawn activities during the relief phase of a magnetospheric substorm are investigated. The carrier system Skylark 12 and the rocket payload structure are described. ESA

N86-32024# Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
MIXING LENGTH AND TURBULENT DIFFUSION COEFFICIENT IN ATMOSPHERIC SIMULATION MODELS [MISCHUNGSWEG UND TURBULENTER DIFFUSIONSKOEFFIZIENT IN ATMOSPHAERISCHEN SIMULATIONSMODELLEN]
Heinrich Wilhelm Detering 1985 119 p In GERMAN
(Rept-25; ISBN-3-923624-03-4; ISSN-0440-2820; ESA-86-97478) Avail: NTIS HC A06/MF A01

The significance of parameterization of turbulent flows in comparison with other model suppositions, as well as the effects of several parameterization methods on the results of numerical models were investigated. For measured and hypothetical flows, the differences in the results obtained with different mixing length suppositions in a one and two-dimensional numerical model with a first kind equation closure are shown. The effect of parameterization of turbulent flows on the interpretation of numerically simulated mesoscale phenomena is discussed. It is shown that the closure which is presently mainly used for strong shear flow, provides realistic results for atmospheric flows (even under diabatic conditions) by a modification of the prognostic energy dissipation equation. For stable lamination a functional dependence of the ratio of heat and momentum diffusion coefficient on the Richardson number which improves the model results is given. It is explained which complex equation structure is required to obtain an approximate value of the turbulent diffusion coefficients. ESA

N86-32364*# Department of Energy, New York. Environmental Measurements Lab.
CALCULATIONS OF COSMOGENIC NUCLIDE PRODUCTION RATES IN THE EARTH'S ATMOSPHERE AND THEIR INVENTORIES
Keran OBrien *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-32025# World Climate Programme, Geneva (Switzerland).
REPORT OF THE JSC/CAS WORKSHOP ON MODELING OF CLOUD TOPPED BOUNDARY LAYER
1985 294 p Workshop held in Fort Collins, Colo., 22-26 Apr. 1986
(WCP-106; WMO/TD-75; ESA-86-97251) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Modeling and parametrization of boundary layer cloud systems are discussed. Studies of radiation budgets, and simulation experiments are included. For individual titles, see N86-32026 through N86-32041. ESA

N86-32026# Purdue Univ., West Lafayette, Ind. Dept. of Geosciences.
EXTRATROPICAL CLOUD-TOPPED BOUNDARY LAYERS OVER THE OCEANS
Ernest E. Agee *In* World Climate Programme Report of the JSC/CAS Workshop on Modeling of Cloud Topped Boundary Layer 1985 12 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Air-sea interactions occurring when cold air moves over warmer water (type one interaction) or when warm air moves over colder water (type two interaction) are described and modeled. Examples of type one occurring to the east of continents and type two to the west are presented showing the open or closed mesoscale cellular convection patterns. The primitive equation model and the turbulence model are discussed showing their inability to simulate the horizontal planform of the convection cell as well as the circulation direction. Suggestions for a comprehensive model are given. ESA

N86-32027# Institute of Ocean Sciences, Sidney (British Columbia).
THE CLOUD-TOPPED BOUNDARY LAYER
Gordon McBean *In* World Climate Programme Report of the JSC/CAS Workshop on Modeling of Cloud Topped Boundary Layer 1985 8 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Results from studies of marine stratocumulus, midlatitude

weather systems and Arctic stratus are examined to identify the main features of the physical processes contributing to the development and evolution of the cloud-topped boundary layer. Previous studies are discussed showing the limitations of global circulation models. The international satellite cloud climatology project, a part of the world climate research program, is described, showing that Arctic stratus layer modeling continues to be a problem. ESA

N86-32028# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
RADIATION IN BOUNDARY LAYER CLOUDS
Y. Fouquart *In* World Climate Programme Report of the JSC/CAS Workshop on Modeling of Cloud Topped Boundary Layer 1985 40 p Sponsored by Programme National d'Etudes de la Dynamique du Climat (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The impact of radiation on boundary layer clouds and its influence on planetary radiation budget are discussed. The studies of the localization of the radiative divergence and its influence upon the entrainment rate are reviewed. The parametrization of the optical properties of boundary layer clouds, the short wave spectral range and the long wave optical properties are also examined. Results of field experiments are used to validate short wave parameterizations, and stratocumulus reflectivity observations are employed to validate satellite data. It is shown that the infrared optical properties of the boundary layer clouds can be adequately modeled in terms of an infrared window emissivity, the influence of scattering being weak. It is recommended that models of the boundary layer include a representation of the radiative processes allowing for horizontal inhomogeneities. ESA

N86-32029# Tartu State Univ. (USSR). Dept. of Geophysics.
PHYSICAL PROPERTIES OF STRATIFORM CLOUDS AND THEIR PARAMETRIZATION
O. A. Avaste *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer (WCP-106) 1985 17 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The properties of stratiform clouds are studied in order to analyze the type and number of parameters needed for calculation of radiative fluxes and flux divergences with adequate accuracy. It is shown that the accuracy of calculations depends greatly on the accuracy of the integral transmittance function, which changes considerably when vapor concentration in the atmosphere is large. It is suggested that satellite measurements reveal climatic signals after statistical data processing even if the accuracy of a single temperature measurement is 1.5 to 2 C. ESA

N86-32030# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THEORY AND OBSERVATION OF CLOUD-TOPPED BOUNDARY LAYER PROCESSES
Wayne H. Schubert *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 11 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The motion field of a convective element is analyzed showing that the updraft has positive buoyancy in the cloud layer and negative buoyancy below. Under the inelastic approximation the nonhydrostatic pressure field can be computed from a diagnostic equation if the temperature and motion fields are known. It is shown that the work done on the subcloud layer by the cloud layer maintains the convective motions of the subcloud layer. Observation data are presented to illustrate the described model. ESA

N86-32031# Colorado State Univ., Fort Collins.
SATELLITE OBSERVATIONS OF THE CLOUD-TOPPED BOUNDARY LAYER
Thomas H. VonderHaar *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 12 p (For primary document see N86-32025 23-47)
(Contracts NAG1-449; N66001-84-C-0186; Grant NSF ATM-84-01229)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The information obtained by satellites about the extent and interannual variability of the stratus clouds near the top of the boundary layer is reviewed. Observations from satellites of the Earth radiation budget are examined. The development of remote sensing methods is discussed. It is shown that satellite observations allow better understanding of the climate impact of these clouds and that a better phenomenology is obtained by these observations. ESA

N86-32032# Research Inst. of Colorado, Fort Collins.
USE OF EXISTING AND SUGGESTED SATELLITE OBSERVATIONS OF REFLECTED SPECTRAL RADIANCE TO ESTIMATE PROPERTIES OF STRATIFORM CLOUDS
Melanie Wetzel and Thomas H. VonderHaar *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 6 p (For primary document see N86-32025 23-47)
(Contract N6601-84-C-0186)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The addition of short wave and infrared channels to meteorological satellites such as CZCS, Nimbus and NOAA series is discussed. The value of the new channels is analyzed for the case of NOAA-6. The infrared observations will show cold cloud surfaces bright and warm surfaces dark, will detect cloud droplets scattering as water vapor absorbed in 2 narrow bands (0.85 and 0.93 micron), and will use another infrared band which makes droplet absorption large and vapor absorption small. ESA

N86-32033# Royal Netherlands Meteorological Inst., De Bilt.
MODELING AND OBSERVATIONS OF THE STRATOCUMULUS-TOPPED ATMOSPHERIC BOUNDARY LAYER
A. G. M. Driedonks *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 24 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Simulations of the dry atmospheric boundary layer with a positive surface heat flux are discussed. They show that its structure is governed by a simple scaling law, while the cloud topped boundary layer depends on a multitude of parameters. It is shown that the turbulent structure of the cloudy layer differs drastically from one case to another. In mixed layer models the basic problem is the formulation of the entrainment rate at the top. The problems found in multilevel models with higher order turbulence closure schemes are also discussed. ESA

N86-32034# National Center for Atmospheric Research, Boulder, Colo.
THE STRUCTURE OF A STRATUS-TOPPED PLANETARY BOUNDARY LAYER AS SEEN THROUGH A LARGE-EDDY SIMULATION
Chin-Hoh Moeng and John C. Wyngaard *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 11 p Sponsored by NSF (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

A planetary boundary layer model which includes turbulence, long wave radiation, and condensation processes is described. The statistics derived from the model-generated data indicate that the contribution of the resolvable scale eddies to the turbulence energy and vertical fluxes of buoyancy and moisture is much larger than that of the subgrid eddies. The analysis of this data set shows implications concerning boundary layer models. It is shown that the ratio of turbulence energy production and consumption rates is 0.04 for Eulerian partitioning and 0.27 for Lagrangian partitioning on mixed layer models. In the case of second order closure models the buoyancy contribution to the pressure gradient temperature covariance is one half of the direct buoyancy production term in the vertical flux equation. ESA

N86-32035# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
KEY PROBLEMS OF PARAMETERIZATION FOR SIMPLE CLOUD-TOPPED BOUNDARY LAYER MODELS
David A. Randall *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 17 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Fractional cloudiness, mesoscale cellular convection, and detached cloud layers and diurnal cycle are discussed. A parameterization for any of the three would find immediate application in atmospheric models. ESA

N86-32036# Meteorological Office, Bracknell (England). Cloud Physics Branch.
NOTES ON MODELING THE CLOUD TOPPED BOUNDARY LAYER
S. Nicholls *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 11 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Aspects of boundary layer models concerning unbroken, nonfreezing stratiform cloud layers are discussed. Evidence from observation data is reviewed. The current state of models is examined. A mixed layer model is described, and the results of a 24 hr integration with this model are given. It is shown that more data are needed to assess when and where model concepts are valid and, if necessary, how new models can be formulated. ESA

N86-32037# National Center for Atmospheric Research, Boulder, Colo.
BOUNDARY LAYER AND CLOUD PARAMETERIZATION IN THE NCAR COMMUNITY CLIMATE MODEL
R. E. Dickinson *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 3 p Sponsored by NSF (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Modifications of the Community Climate Model are made and a set of parameters chosen in order to describe cloud-topped boundary layer phenomena. A layer structure treatment is adopted. It is suggested that a useful focus to validate models is the fluxes of heat, moisture, momentum and radiation from and to the surface and their redistribution within atmospheric layers. ESA

N86-32038# European Centre for Medium-Range Weather Forecasts, Reading (England).
PARAMETERIZATION OF THE CLOUD-TOPPED BOUNDARY LAYER IN A GLOBAL FORECAST MODEL
G. Sommeria, J. Slingo, and M. Tiedtke *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 20 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The formulation of turbulent transports associated with shallow convection, the effect of its introduction in a global circulation model, and the impact of the associated cloud cover are discussed. Different cloud types resulting from the presented equations are almost mutually exclusive and may be combined without difficulty. The cloud distributions produced by the scheme compare well with Meteosat images. ESA

N86-32039# Meteorological Office, Bracknell (England).
SIMULATION OF CLOUDINESS WITH THE UK METEOROLOGICAL OFFICE 11-LAYER AGCM
A. Slingo and R. C. Wilderspin *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 13 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The ability of AGCM type models to represent the global distribution of cloudiness is assessed. Errors in the low cloud field over the subtropical oceans are of particular concern as the model is being coupled to an ocean model for long-range climate sensitivity experiments. The reason for errors and proposed changes to the model are discussed. Results from an integration with model predicted cloudiness are presented. In spite of the errors discussed, the results are encouraging. ESA

N86-32040# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.
THE SENSITIVITY OF ONE MONTH GCM FORECASTS AT GFDL TO ZONALLY SYMMETRIC CLOUDS, QUASI-REALISTIC SPECIFIED CLOUDS, AND MODEL-PREDICTED CLOUDS
C. T. Gordon *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 21 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

A scheme to generate radiatively constrained low and high cloud fields of specified sigma levels is described. The procedure is carried out at each model grid point. It entails representing the local grid point values of observed short wave and long wave radiation as Taylor series of model diagnosed radiative flux with respect to low and high effective cloud amount, plus a residual. Analyses of Nimbus 7 narrow field of view Earth radiation budget broad band radiative fluxes were used. It is shown that quasi-realistic cloud radiation forcing appears to have a favorable impact on the 5 day mean predicted atmospheric circulation. The results underscore the importance of developing improved cloud prediction schemes and subgrid scale parametrizations of turbulent transport in the planetary boundary layer in the presence of clouds. ESA

N86-32041# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
BOUNDARY LAYER CLOUDS IN THE ISCCP DATA SETS
Ehrhard Raschke *In* World Climate Programme Report of the JSC/CAS Worskshop on Modeling of Cloud Topped Boundary Layer 1985 23 p (For primary document see N86-32025 23-47)
Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The possibilities to map boundary layer clouds with operational satellite imagery are reviewed. The data consist of images of the Earth within spectral regions of reflected solar and emitted thermal radiation, limited to atmospheric windows. The data are additionally degraded in their spatial resolution to pixels of 10 to 15 km in size and sampled at distances from 30 to 50 km. It is concluded that from the ISCCP reduced radiance data sets, the boundary layer clouds can be mapped with restrictions which are discussed. ESA

N86-32042# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ON THE EVOLUTION OF PRECIPITATION ASSOCIATED WITH A WINTERTIME EAST COAST CYCLONE: A GALE PRELIMINARY STUDY M.S. Thesis
Robert D. Bievins 1985 112 p
(AD-A166375; AFIT/CI/NR-86-17T) Avail: NTIS HC A06/MF A01

This thesis analyzes and explains the precipitation structure of the 10-12 February 1983 east cost cyclone, which is typical of the type the GALE 1986 field project hopes to study. Careful hourly analysis of surface weather and precipitation were conducted using all avalable data obtained from the National Climatic Data Center at Asheville, N.C. Surface kinematic calculations were accomplished and compared to the observed precipitation pattern. Vorticity and divergence patterns were found to correlate well with the cold-air damming and the coastal front associated with the cyclone studied, but failed to correlate well with the observed precipitation structure. Adiabatic and kinematic vertical motion profiles were better correlated with the observed precipition, but failed to adequately explain the observed movement of precipitation. Subsequent insentropic analysis, similiar to that of the British researchers, allowed for the three dimensional analysis of air flow. Cross sections were analyzed for potential temperature, mixing ratio, and wind. These analyses revealed a warm conveyor belt and cold conveyor belt similiar to the Carlson (1980) model for midwest cylcones. GRA

N86-32043# Air Command and Staff Coll., Maxwell AFB, Ala.
SECULAR CLIMATIC PATTERNS OF THE NORTH CENTRAL GREAT PLAINS AND THE CONTINENTAL US M.S. Thesis
Karen Jean Praner 1985 173 p
(AD-A166743; AFIT/CI/NR-86-51T) Avail: NTIS
HC A08/MF A01 CSCL 04/2

Monthly mean maximum temperatures and total precipitation data (1900-1970) were compiled for 144 carefully selected stations in the continental U.S. The north central great plains (NCGP) was divided into regions of similar temperature and precipitation patterns using 39 stations representative of the NCGP. In a like manner, the 144 U.S. stations were grouped into regions with similar patterns of mean annual temperature and total annual precipitation; weighted mean annual temperature and total precipitation series were derived by area-weighting the regional series. Comparison of regional and mean series revealed marked differences between series. Tests of normality and homogeneity of means were conducted for the mean annual temperature and total annual precipitation series; it was determined that several distinctly different periods of temperature and precipitation existed between 1910 and 1970 for both series. The presence of consecutive periods of dissimilar climatic patterns within the 70-year series of climatic elements implies that climate exhibits jump discontinuities which must be explored.
Author (GRA)

N86-32044# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONTINENTALITY: ITS ESTIMATION AND PHYSICAL SIGNIFICANCE M.S. Thesis
Juan M. YeeFong Dec. 1985 73 p
(AD-A167111; AFIT/CI/NR-86-61T) Avail: NTIS
HC A04/MF A01 CSCL 04/2

An attempt has been made to quantify continentality better than exists in current indexes. Conventional indexes of continentality were examined and their deficiencies noted. Several different approaches were taken to develop alternative continentality indexes. These approaches were: dividing annual temperature range by the difference between summer and winter isolation, regressing annual temperature range on latitude and isolating the residuals such that positive ones represent continental locations and negative ones indicate maritime, or less continental, locations; and finding the summer and winter lag of temperature behind radiation with the cubic spline interpolation technique. All three approaches were used to examine the North American continent as a whole. In addition, the Rocky Mountain and Great Lakes-Appalachia regions were chosen for mesoscale analysis in order to determine what effect elevation and large water bodies have on lag. Isopleth analyses of the plotted values of the proposed alternative indexes were compared with conventional index patterns for North America and with each other. Each newly developed index was evaluated as an appropriate measure of continentality and a physical (meteorological) explanation attempted for the patterns.
Author (GRA)

N86-32045# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
DESIGN WIND ANALYSIS
Robert D. LaFebre Mar. 1986 20 p
(AD-A167576; USAFETAC/PR-86/001) Avail: NTIS
HC A02/MF A01 CSCL 04/2

A comprehensive literature review on methods of design wind analysis is given. The report notes that there is no best way to raise winds from one level to another, pointing out that meteorologists and engineers have separate preferences. While one method may work well for one investigation, it may result in false conclusions when used for another.
GRA

N86-32046# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
KOLN BONN, WEST GERMANY LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), PARTS A, C-F Data Summary Report, Sep. 1975 - May 1985
14 Nov. 1985 267 p
(AD-A167649; USAFETAC/DS-85/058-Pt-A-c,f) Avail: NTIS
HC A12/MF A01 CSCL 04/2

A statistical data summary of surface weather observation climatology for Koln Bonn West Germany is given. This summary is similar to the Revised Uniform Summary of surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART A, Weather Conditions and Atmospheric Phenomena; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; and PART F, Pressure Summaries. Note that PART B, Precipitation, is omitted. See USAFETAC/TN-83/001 9AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs), for complete descriptions of contents and instructions for use.
GRA

N86-32047# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: PETERSON AFB, COLORADO SPRINGS, COLORADO Data Summary Report, Sep. 1942 - Mar. 1948; Jul. 1948 - Mar. 1985
14 Nov. 1985 306 p
(AD-A167650; USAFETAC/DS-85/059-Pt-A-F) Avail: NTIS
HC A14/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations is given for Peterson AFB, Colorado Springs CO. The summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries.
GRA

N86-32048# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: MACDILL AFB, FLORIDA Data Summary Report, May 1941 - Jun. 1947; Aug. 1947 - Aug. 1985
19 Nov. 1985 305 p
(AD-A167651; USAFETAC/DS-85/060-Pt-A-F) Avail: NTIS
HC A14/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations is given for Macdill AFB, FL. The summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries. See USAFETAC/TN-83/001 (AD-A132 186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs) for complete descriptions of contents and instructions for use.
Author (GRA)

N86-32049# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: CAPE NEWENHAM, ALASKA Data Summary Report, Aug. 1953 - Nov. 1984
29 Nov. 1985 307 p
(AD-A167652; USAFETAC/DS-85/061-Pt-A-F) Avail: NTIS
HC A14/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations is given for Cape Newenham, Alaska. The summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries.
Author (GRA)

N86-32050# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: GEORGE AFB, CALIFORNIA Data Summary Report, Feb. 1942 - Dec. 1985
21 Apr. 1986 300 p
(AD-A167653; USAFETAC/DS-86/016-Pt-A-F) Avail: NTIS

HC A13/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations is given for: George AFB CA. Summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries. See USAFETAC/TN-83/001 (AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs) for complete descriptions of contents and instructions for use. GRA

N86-32051# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: WHITE SANDS MR, NEW MEXICO Data Summary Report, Aug. 1947 - Dec. 1962

22 Apr. 1986 287 p

(AD-A167654; USAFETAC/DS-86/017-Pt-A-F) Avail: NTIS HC A13/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations for White Sands MR NM is given. The summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries. See USAFETAC/TN-83/001 (AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs) for complete descriptions of contents and instructions for use. GRA

N86-32052# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

MISAWA AB, JAPAN LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), PARTS A, C-F Data Summary Report, Mar. 1976 - Feb. 1986

22 Apr. 1986 274 p

(AD-A167655; USAFETAC/DS-86/018-Pt-A-c,f) Avail: NTIS HC A12/MF A01 CSCL 04/2

A statistical data summary of surface weather observation climatology for: Misawa AB Japan is given. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART A, Weather Conditions and Atmospheric Phenomena; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; and PART F, Pressure Summaries. Note that PART B, Precipitation, is omitted. See USAFETAC/TN-83/001 9AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs), for complete descriptions of contents and instructions for use. GRA

N86-32053# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

CAMP PAGE, SOUTH KOREA LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), PARTS A, C-F Data Summary Report, Dec. 1974 - Dec. 1980

29 Apr. 1986 194 p

(AD-A167656; USAFETAC/DS-86/019-Pt-A-c,f) Avail: NTIS HC A09/MF A01 CSCL 04/2

A statistical data summary of surface weather observation climatology for: Camp Page South Korea is given. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART A, Weather Conditions and Atmospheric Phenomena; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; and PART F, Pressure Summaries. Note that PART B, Precipitation, is omitted. See USAFETAC/TN-83/001 9AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs), for complete descriptions of contents and instructions for use. GRA

N86-32054# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F: CASTLE AFB, CALIFORNIA Data Summary Report, Jan. 1942 - Dec. 1970; Jan. 1973 - Feb. 1986

29 Apr. 1986 296 p

(AD-A167657; USAFETAC/DS-86/020-Pt-A-F) Avail: NTIS HC A13/MF A01 CSCL 04/2

A six-part statistical data summary of surface weather observations for: Castle AFB CA is given. The summary consists of: PART A, Weather Conditions and Atmospheric Phenomena; PART B, Precipitation; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; PART F, Pressure Summaries. See USAFETAC/TN-83/001 (AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs) for complete descriptions of contents and instructions for use. GRA

N86-32055# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

KWANG JU AB, SOUTH KOREA LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), PARTS A, C-F Data Summary Report, Jan. 1975 - Dec. 1984

2 May 1986 256 p

(AD-A167659; USAFETAC/DS-86/022-Pt-A-c,f) Avail: NTIS HC A12/MF A01 CSCL 04/2

A statistical data summary of surface weather observation climatology for: Kwang JU AB South Korea is given. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART A, Weather Conditions and Atmospheric Phenomena; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; and PART F, Pressure Summaries. Note that PART B, Precipitation, is omitted. See USAFETAC/TN-83/001 (AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs), for complete descriptions of contents and instructions for use. GRA

N86-32056# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

PATRICK AFB, FLORIDA LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), PARTS A, C-F Data Summary Report, Mar. 1976 - Feb. 1986

2 May 1986 248 p

(AD-A167660; USAFETAC/DS-86/023-Pt-A-c.f) Avail: NTIS HC A11/MF A01 CSCL 04/2

A statistical data summary of surface weather observation climatology for: Patrick AFB FL is given. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART A, Weather Conditions and Atmospheric Phenomena; PART C, Surface Winds; PART D, Ceiling and Visibility; PART E, Psychrometric Summaries; and PART F, Pressure Summaries. Note that PART B, Precipitation, is omitted. See USAFETAC/TN-83/001 9AD-A132186), An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs), for complete descriptions of contents and instructions for use. GRA

N86-32057# Naval Postgraduate School, Monterey, Calif.

A LINEAR STABILITY ANALYSIS OF THE RAPID DEVELOPMENT OF AN EXTRATROPICAL CYCLONE M.S. Thesis

Raymond F. Toll, Jr. Mar. 1986 112 p

(AD-A167808) Avail: NTIS HC A06/MF A01 CSCL 04/2

The phenomenon of the rapid growth and development of an extratropical cyclone over the east coast of the United States (the Carolinas storm of March 1984) is studied through a linear stability analysis. Analyses of the cyclone structure suggest barotropic and baroclinic instabilities may be important. A linear stability model is used to investigate the roles and relative importance of shortwave baroclinic instability and barotropic instability in the growth and development of the storm. The growth rates, phase speeds and structure obtained from the linear model are consistent with those derived from observations. Energy budget results indicate that the vertical and horizontal barotropic terms are at least as important as the baroclinic term. It appears that the early growth and development of the cyclone can be explained through the contributions of barotropic and baroclinic instabilities without including convection. GRA

N86-32058# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF STORM-RELATED PARAMETERS ON THE ACCURACY OF THE NESTED TROPICAL CYCLONE MODEL M.S. Thesis
Brian J. Williams Mar. 1986 108 p
(AD-A167809) Avail: NTIS HC A06/MF A01 CSCL 04/2

The performance of the Nested Tropical Cyclone Model (NTCM) for 542 track forecasts in the western North Pacific is evaluated with respect to five storm-related parameters: intensity, 12-h change in intensity, latitude, longitude and size. This study is intended to aid the operational forecaster in deciding when to use the NTCM-based storm-related parameters at the forecast time. The storm-related parameters are divided into three subsamples (about 180 in each) and the forecasts are evaluated in terms of the mean forecast error, median forecast error and systematic (zonal and meridional) error. Cross-track (CT) and along-track (AT) components are computed relative to a Climatory and Persistence (CLIPER) track. A scoring system (M) that assesses penalty points for forecasts in incorrect terciles is used to compare the accuracy of the NTCM and CLIPER forecasts within the subsamples. For the entire sample, the NTCM has a slow bias, especially at the 12- through 36-h forecast periods. It also performs better for storms with initial latitudes south of 13 N and initial longitudes west of 129E. For very large storms, the NTCM forecasts have both left-of-track and westward biases which indicate problems of the NTCM in predicting recurvature of such systems. The NTCM (which has a 60-kt bogus) forecasts for storms with initial intensities between 50 and 75 kt have much lower CT/AT M scores and smaller forecast errors than the subsamples with initial intensities less than 50 kt. GRA

N86-32059# Naval Postgraduate School, Monterey, Calif.
A DIAGNOSTIC INVESTIGATION OF EXPLOSIVE MARITIME CYCLOGENESIS DURING FGGE M.S. Thesis
Darrell H. Smith Mar. 1986 55 p
(AD-A167810) Avail: NTIS HC A04/MF A01 CSCL 04/2

A collection of explosive and non-explosive storm groups is selected from the western North Atlantic Ocean and western North Pacific Ocean. Explosive cyclogenesis is defined as having a mean sea level pressure fall of 1 mb h for 24 h. Using ECMWF (European Center for Medium Range Forecasts) analyses with FGGE SOP-1 data, the storm environment properties of both storm types are analyzed and compared. Storm environment properties include static stability, layer averaged potential temperature, low level vorticity, vorticity advection, mean and eddy modes of vorticity transport, divergence and kinematic vertical velocities. These properties are compared between the cyclone types at 0 h, 12 h and 24 h periods as well as the overall 24 h average. The largest differences between the explosive group and the non-explosive group are found in the upper level divergence and vorticity advection. The explosive systems are warmer; however, static stabilities of the two groups are quite similar. GRA

N86-32060# Naval Air Systems Command, Washington, D. C.
GUIDE TO STANDARD WEATHER SUMMARIES AND CLIMATIC SERVICES
Apr. 1986 188 p
(AD-A168099; NAVAIR-50-1C-534) Avail: NTIS HC A09/MF A01 CSCL 04/2

Part 1 of this publication provides a description of published and unpublished climatological summaries. A list of major climatic publications produced by NOCD Asheville (with instructions for obtaining copies) has been included following the Introduction. Part II of this publication is a catalogue of published and unpublished climatological summaries in continent-country-station order. There are twenty-three columns headed by a particular climatic summary or group of summaries. The availability of a climatic summary for a specific station is indicated by a number (the number of years of data used for that summary) under the summary heading. The availability of a World-wide Airfield Summary is indicated by an alphabetic character. GRA

N86-32061# Department of Energy, Washington, D. C. Carbon Dioxide Research Div.
PROJECTING THE CLIMATIC EFFECTS OF INCREASING CARBON DIOXIDE
M. C. MacCracken, ed. and F. M. Luther, ed. Dec. 1985 394 p Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(DE86-006810; DOE/ER-0237) Avail: NTIS HC A17/MF A01

This report presents the current knowns, unknowns, and uncertainties regarding the projected climate changes that might occur as a result of an increasing atmospheric CO2 concentration. Further, the volume describes what research is required to estimate the magnitude and rate of a CO2-induced climate change with regional and seasonal resolution. Separate abstracts have been prepared for the individual papers. DOE

N86-32062# East Anglia Univ., Norwich (England). School of Environmental Sciences.
VALIDATION OF GENERAL CIRCULATION MODEL (GCM) CONTROL RUNS
B. D. Santer and T. M. L. Wigley Jan. 1986 136 p
(Contract W-7405-eng-48)
(DE86-009697; UCRL-15789) Avail: NTIS HC A07/MF A01

The simulation performance of three General Circulation Models (GCMs) is examined in a North American/European study area (20°N-85°N; 180°W-60°E). Mean sea level (m.s.l.) pressure fields simulated by the OSU two-layer AGCM (fixed SST experiment), the GISS nine-layer AGCM, and the synchronously-coupled OSU CGCM are compared with observed data, and the significance of differences between observed and simulated m.s.l. pressure distributions is assessed using simple grid-point t-tests and spatial field correlations. Objective indices have been developed which are physically relatable to the properties of quasi-stationary surface ridges and trough. These indices have been used to test whether the models are capable of reproducing important features of the observed seasonal cycles of Iceland Low and Azores High intensity and position. Such objective diagnostic tests enable quantitative analysis of inter-model differences in center of action intensity and location, and are also useful in evaluating the effects of changes in grid resolution, ocean representation, or parameterizations on stationary wave properties at the surface. it is demonstrated that detailed regional examination of model performance is justifiable, even given the spatial resolution of currently operational models, and may provide important diagnostic information for modeling groups. DOE

N86-32063# Regensburg Univ. (West Germany). Inst. fuer Festkoerperphysik.
MEASUREMENT OF THE WIND FIELD. SIMULTANEOUS WIND VELOCITY MEASUREMENTS AT DIFFERENT ALTITUDES WITH HIGH TIME RESOLUTION FOR THE SPECIFICATION OF WIND ENERGY CONVERTERS Final Report, Mar. 1983
Gustav Obermair, Klaus Berberich, Rainer Obermair, and Lorenz Jarass Bonn, West Germany BMFT Dec. 1985 154 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-T-85-141; ISSN-0340-7608; ESA-86-97437) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 32

Two cylindrical high radio towers, 1.50 m in diameter, were used to study the dynamic behavior of wind energy converters and the central and adjusting systems with a time resolution of 1 sec at different altitudes at a coastal station and at an inland station. Models and criteria were developed to produce statistical data on the spacetime structure of the horizontal wind field and to evaluate one-point measurements corresponding to wind velocity, direction, acceleration and direction changes; and multiple-point measurements of gust factors, autocorrelations, velocity and direction gradients, and statistical distributions. The results are used to describe the simulation of a real wind power plant. ESA

N86-32064# Technische Univ., Berlin (West Germany). Fachbereich Informatik.
LOCAL JARGON IN WEATHER REPORTS [LOKALE DEIXIE IN WETTERBERICHTEN]
Artrid Jasse May 1984 8 p In GERMAN Submitted for publication Sponsored by Bundesministerium fuer Forschung und Technologie
(KIT-18; ESA-86-97429) Avail: NTIS HC A02/MF A01

Local jargon used in weather reports was studied because of its requirements for the imaginative faculty and hence faculty of text understanding. It is known that local jargon is not solely a case for linguists. It has also to be treated with a view to the structure of knowledge which serves as its basis. Further knowledge of the processes of spatial imaginative faculty can substantially contribute to the description of local jargon. ESA

N86-32065# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Instrumentele.
ERROR CONTROL OF METEOROLOGICAL MEASUREMENTS [FOUTENCONTROLE BIJ METEOROLOGISCHE METINGEN]
J. J. M. vanGorp and H. M. vanderKolk 1985 73 p In DUTCH
(KNMI-TR-76; B8661060; ISSN-0169-1708; ESA-86-97728) Avail: NTIS HC A04/MF A01

A method of automatic control of measurements was developed for the automation of measurements of meteorological parameters. The detection of defects and disturbances by pattern recognition is discussed. It is explained which characteristics of the measuring signal are used to detect situations differing from the expected normal situation. The spectrum is analyzed in order to find these characteristics. This spectrum can be estimated by using the calculation of the discrete spectrum via fast Fourier transformation. ESA

N86-32066# World Meteorological Organization, Geneva (Switzerland).
MONSOONS
P. K. Das 1986 177 p
(WMO-613; ISBN-92-63-10613-4; ESA-86-97657) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Planetary and regional aspects of monsoons are introduced. Barotropic and baroclinic instability; numerical simulation; monsoons and orographic barriers; oceanic response to monsoon winds; and long range prediction are discussed. ESA

N86-32067# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysisch Meteorologisch.
CLIMATOLOGICAL RESEARCH IN THE PERIOD 1962-1978 IN THE DELTA REGION, SOUTH FLEVOLAND, AND LAUWERS REGION; DUTCH WATER TEMPERATURES IN THE PERIOD 1860 TO 1985 Final Report [KLIMATOLOGISCH ONDERZOEK IN HET TIJDVAK 1962-1978 IN DELTAGEBIED, ZUIDFLEVOLAND EN LAUWERSGEBIED, EN NEDERLANDSE WATERTEMPERATUREN 1860-1985]
P. C. T. vanderHoeven and G. vanVliet 1986 132 p In DUTCH; ENGLISH summary
(KNMI-169; B8664064; ESA-86-97722) Avail: NTIS HC A07/MF A01

Observations of the heat balance of sea arms, mesoclimatological mapping, and climatological variations at dams and reclaimings are reported on. The results of climatological measurements, the observation of the evolution of climatological variations in Lauwers sea and Grevelingen, and the measurement of water temperatures in the Netherlands since 1860 are presented. ESA

N86-32068# Royal Netherlands Meteorological Inst., De Bilt.
CLIMATOLOGICAL DATA OF STATIONS IN THE NETHERLANDS. NO. 25: A CLIMATOLOGY OF THE MAIN OBSERVATORY AT DE BILT FOR THE PERIOD 1901-1984
1985 71 p In ENGLISH and DUTCH
(KNMI-150-25; ISSN-0169-3581; ESA-86-97723) Avail: NTIS HC A04/MF A01

Meteorological observations concerning temperature, precipitation, sunshine, and pressure during 1 January 1901 through 31 December 1984 are presented. Monthly and decadal means and absolutes of highest and lowest temperatures were calculated, along with seasonal and annual data. ESA

N86-32069# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Centrale Weerdienst.
METEOROLOGICAL WORK STATION METIS: A GLANCE AT THE FUTURE [METEOROLOGISCH WERKSTATION METIS: EEN BLIK IN DE TOEKOMST]
G. D. G. Folkers and J. M. Terpstra Apr. 1984 50 p In DUTCH
(KNMI-TR-74; B8662755; ISSN-0169-1708; ESA-86-97726) Avail: NTIS HC A03/MF A01

The functions of a meteorological work station were analyzed. The situation of the meteorological sites De Bilt, Schiphol and Rotterdam is summarized. ESA

N86-32070# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysische Meteorologie.
OBSERVATIONS OF SURFACE WATER TEMPERATURE IN THE NETHERLANDS FROM 1860: DESCRIPTION OF THE DATA FILE
P. C. T. vanderHoeven 1985 26 p In DUTCH; ENGLISH summary
(KNMI-TR-75; B8661059; ISSN-0169-1708; ESA-86-97727) Avail: NTIS HC A03/MF A01

Files of monthly averages of all available observations of water temperature in the Netherlands since 1860 were made. Files of background data such as river discharges, precipitation, salinity, and air temperature are available. The available files are listed. ESA

N86-32071# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysische Meteorologie.
OBSERVATIONS OF SURFACE WATER TEMPERATURE IN THE NETHERLANDS FROM 1860: THE TEMPERATURE REGIME AND THE CHANGES IN IT
P. C. T. vanderHoeven 1985 114 p In DUTCH; ENGLISH summary
(KNMI-WR-85-6; B8662754; ISSN-0169-1651; ESA-86-97731) Avail: NTIS HC A06/MF A01

The results of different analyses of water temperature observations in the Netherlands covering 2500 station-years are presented. The winter water temperature was observed by IR satellite photos. The history of the station network is depicted. The water movements which are essential to understand the regime of water temperatures are discussed. The relation between all available 10 yr water temperature averages is described. Peculiarities of the annual water temperature are shown by Lissajous figures. Annual averages were analyzed by comparing their deviations with respect to the standard. ESA

N86-32072# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
A BISPECTRAL METHOD FOR THE HEIGHT DETERMINATION OF ICE CLOUDS
Werner Pollinger and Peter Wendling Dec. 1985 52 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-03; ISSN-0171-1342; ESA-86-97586) Avail: NTIS HC A04/MF A01; DFVLR, Cologn, West Germany DM 36.50

A bispectral method for the height determination of optically thin ice clouds from satellite measurements at two adjacent points of an ice cloud layer was developed. Using 2 wavelengths in the spectral range of the water vapor band at 6.3 microns and in the window range at 11 microns, a transcendental equation was derived under the assumption that both points of the cloud have the same temperature but different optical thickness. The solution of the transcendental equation yields the cloud temperature, and the height via the temperature profile which must be known. The effect of the water vapor above the cloud is corrected for using a radiation transfer model. ESA

N86-32073*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics and Research.
NATIONAL CLIMATE PROGRAM: EARLY ACHIEVEMENTS AND FUTURE DIRECTIONS Final Report
May 1986 67 p Proceedings of the Workshop held at Woods Hole, Massachusetts, 15-19 Jul. 1985; sponsored by NASA, NSF, NOAA and DOE
(Contract NA79RA-C-000104)
(NASA-CR-177153; NAS 1.26:177153; PB86-198975) Avail: NTIS HC A04/MF A01 CSCL 04B

Activities of the National Climate Program since 1978 are reviewed, and outlines new directions which should be emphasized over the next five years or so. These are discussed under the subentities of climate system research; climate impacts; and climatic data, information, and services. GRA

N86-32006*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE SYSTEMS REQUIREMENTS DEFINITION
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 p 112 (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 04B

N86-32009*# Little (Arthur D.), Inc., Cambridge, Mass.
A PROCEDURE FOR SPACE SDR PRIORITIZATION
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 12 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-32074# Naval Underwater Systems Center, Newport, R.I.
ACOUSTIC DESCRIPTION OF SOUTH ATLANTIC OCEAN WARM CORE EDDY
Linda S. Petitpas and David G. Browning 10 Mar. 1986 17 p
(AD-A166323; NUSC-TD-7615) Avail: NTIS HC A02/MF A01 CSCL 20/1

This document contains the viewgraph presentation which investigates the thermohaline/baroclinic scales of the meso-scale eddies associated within the Brazil Malvinas (Falkland) Confluence. One of the eddies investigated was a warm core anti-cyclonic eddy centered about 43 deg 50 min S and 54 deg 15 min W (18-19 October) with a diameter of 125 km. The XBT's and CTD's taken through the eddy were used with a range dependent acoustic prediction ray model (GRASS) to model a cross section of the eddy at 50 Hz comparing propagation loss with source depths of 25, 150, and 500 m and receiver depths of 25, 150, and 500 m. Comparisons were done propagating through the eddy, from the outer edge to the eddy interior, and from the interior to the outer edge. The results were compared with a no eddy, range independent situation. Results showed that due to the presence of a surface duct in the warm core eddy the greatest impact was found propagating a shallow source with a shallow receiver. No effects were seen below 300 m, similar to the North Pacific and Greenland Sea eddies. GRA

N86-32075# Army Engineer District, Los Angeles, Calif. Coastal Resources Branch.
GEOTECHNICAL DATA INVENTORY, SOUTHERN CALIFORNIA COASTAL ZONE, CAPE SAN MARTIN (MONTEREY COUNTY) TO MEXICAN BORDER
Dec. 1985 191 p
(AD-A167734; CCSTWS-85-5) Avail: NTIS HC A09/MF A01 CSCL 08/6

The data inventoried in this report covers geotechnical subjects such as the physical properties of the sediment, the presence of landslides in the drainage basin, the productivity of the drainage basin, as well as data on the rate of cliff erosion. Information on geological processes such as the loss of sand to sinks such as submarine canyons, or beach sand-dune build up is also given. The data on the physical properties of the sediments includes texture and petrographic information on samples that were collected from submarine canyons, the continental shelf, the littoral zone, lagoons and dunes, as well as cliffs and drainges. The data is presented both as tabular information and as map indexes. The map indexes show the aerial coverage of the reports from which the data was abstracted. Author (GRA)

N86-32076# Scripps Institution of Oceanography, La Jolla, Calif. Ocean Engineering Research Group.
COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY: NEARSHORE BATHYMETRIC SURVEY REPORT, SAN DIEGO REGION Interim Data Report, Nov. 1983 - Feb. 1985
C. Gable, J. Wanetick, S. Schuette, J. DeGraff, and J. Thomas
Dec. 1985 569 p
(Contract DACW09-83-C-0045)
(AD-A168119; CCSTWS-85-3) Avail: NTIS HC A24/MF A01 CSCL 08/10

The purpose of report is to present the results of bathymetric surveys of the nearshore region to a depth of 6 meters relative to mean lower low water (MLLW) at approximately one hundred (100) selected profile stations between Dana Point and the United States/Mexican border. Sediment sampling and measurement of offshore survey stakes/reference rods at specified ranges and depths were also conducted to complement these nearshore bathymetric surveys. The first nearshore bathymetric survey report (CCSTWS, 84-2, April 1984) discussed in detail the surveying techniques and methodologies used to accomplish the goals of this study and provided nearshore profile, sediment sample and reference rod data for Survey 1 (October 1983 to January 1984). This report will supplement and supersede Survey Report no. 1 by providing an updated discussion on profiler system modifications, correcting euoneous survey and sediment sample data entries for Survey No. 1 and provide all additional survey and sediment sample data for Survey 2 (February 1984 to July 1984) and Survey 3 (October 1984 to February 19 85). It is recommended that Survey 1 Data not be used as the baseline survey until a larger survey data base is obtained for comparative analysis.
Author (GRA)

N86-32077# World Climate Programme, Geneva (Switzerland). Scientific Committee for Oceanic Research.
WORLD CLIMATE RESEARCH PROGRAM. GENERAL CIRCULATION OF THE SOUTHERN OCEAN: STATUS AND RECOMMENDATIONS FOR RESEARCH, A REPORT BY SCOR WORKING GROUP 74
Oct. 1985 65 p
(WCP-108; WMO/TD-86; ESA-86-97252) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Major gaps in the knowledge of the general circulation of the Southern Ocean, bearing in mind its relevance to biology and climate were identified. Physical and chemical programs to investigate these problems were outlined. Interactions between the Southern Ocean and the subtropics; the Antarctic circumpolar current; the subpolar zone; shelf-slope processes and deep water formation; sea level observations; and air sea ice interaction were discussed. ESA

N86-32078# Institute of Oceanographic Sciences, Wormley (England).
THE CTD DATA FROM THE MADEIRA ABYSSAL PLAIN. CHARLES DARWIN CRUISE 1/85
P. M. Saunders 1985 79 p Sponsored by UK Dept. of the Environment
(IOS-217; DoE/RW/85.181; PECD7/9/216; ESA-86-97266) Avail: NTIS HC A05/MF A01

Lists and graphs of conductivity-temperature-depth (CTD) data taken aboard RRS Charles Darwin during February 1985 for sites considered for high level radioactive waste disposal are presented. The majority of the lowerings were made in support of the development of deep SOFAR floats near 32 N 24 W and of moorings near 31 30 N 25 W (Great Meteor East site). Others were made on a basin-wide section along 32 N. All CTD data is compared with reversing thermometer observations and with measurements of salinity and dissolved oxygen derived from samples. ESA

N86-32079# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Oceanografisch Onderzoek.
EVALUATION OF WAVE CALCULATIONS USING THE MODEL GONO, IN THE PERIOD OCTOBER 1983 - APRIL 1984 [EVALUATIE VAN DE GOLFBEREKENINGEN MET GONO OVER DE PERIODE OKTOBER 1983 - APRIL 1984]
E. Bouws, G. J. Komen, R. A. vanMoerkerken, H. H. Peeck, and M. J. M. Saraber 1984 53 p In DUTCH; ENGLISH summary
(KNMI-TR-56; ISSN-0169-1708; ESA-86-97724) Avail: NTIS HC A04/MF A01

Results of the wave model GONO on sea wave height, low frequency wave height, wind speed, and wind direction are given. The evaluation is made by a comparison with observations at Euro, Ymuiden, and Pennzoil in the southern North Sea, and Auk and Brent in the northern North Sea. The differences in wind velocity and wave results are small. The results demonstrate the quality of analyses and prognoses. ESA

N86-32080# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Oceanographisch Onderzoek.
TIME SEQUENCE OF THE ROYAL DUTCH METEORLOGICAL INSTITUTE'S OPERATIONAL WAVE MODEL GONO, OCTOBER 1983 - APRIL 1984. SUPPLEMENT [TIJDREEKSEN VAN HET KNMI OPERATIONELE GOLFMODEL GONO, OKTOBER 1983 - APRIL 1984]
E. Bouws, G. J. Komen, R. A. vanMoerkerken, H. H. Peeck, and M. J. M. Saraber 1984 38 p In DUTCH
(KNMI-TR-56-Suppl; ESA-86-97725) Avail: NTIS HC A03/MF A01

Time sequences (October 1983 to April 1984) of wave height, wind speed, and wind directions calculated by the wave model GONO for the locations Euro, Ymuiden, and Pennzoil in the southern North Sea, and Auk and Brent in the Northern North Sea are given. ESA

N86-32081# Rome Univ. (Italy). Dipt. di Fisica.
PRELIMINARY REPORT ON THE HYDROLOGICAL MEASUREMENTS CARRIED OUT IN THE SOUTHERN TYRRHENIAN SEA AND IN THE MESSINA STRAIT [RAPPORTO PRELIMINAIRE SUI RISULTTATI DELLE MISURE IDROLOGICHE ESEGUITE NEL TIRRENO MERIDIONALE E NELLO STRETTO DI MESSINA]
Luciano Capitanio, Roberto Dorazio, Guardiani Pino, Lama Federico, Manuella Paielli, Andrea Pace, Ettore Salusti, Juana SanEmeterio, Enrico Siesni, and Enrico Zambianchi 16 Dec. 1985 43 p In ITALIAN
(Preprint-489; ESA-86-97923) Avail: NTIS HC A03/MF A01

An oceanographic campaign was carried out to verify satellite observation data. The measurements include temperature, salinity and density profiles. The detailed data is presented. Computer processed data analysis is also presented. ESA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-32082# Defence Research Information Centre, Orpington (England).
EXTERNAL RESPIRATION, GAS EXCHANGE, AND BLOOD OXYGEN PARAMETERS IN ACUTE METHEMOGLOBINEMIA
M. M. Seredenko, V. P. Pozharov, and N. G. Sidoryak Dec. 1985 13 p Transl. into ENGLISH from Fiziologicheskii Zhurnal (Kiev, USSR), v. 31, no. 3, 1985 p 262-266
(DRIC-T-7663; BR98339; ESA-86-97263) Avail: Issuing Activity

Hemic hypoxia in rats was studied. Subcutaneous injection of sodium nitrite into rats leads to development of pronounced hemic hypoxia, accompanied by inhibition of the external respiratory function, decrease in oxygen consumption, and development of arterial hypoxemia. ESA

N86-32083*# Management and Technical Services Co., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 7
Lydia Razran Hooke, ed., Mike Radtke, ed., Victoria Garshnek, ed., Ronald Teeter, ed., and Joseph E. Rowe, ed. (Library of Congress, Washington, D. C.) Washington NASA Aug. 1986 113 p
(Contract NASw-3676)
(NASA-CR-3922(08); NAS 1.26:3922(08)) Avail: NTIS HC A06/MF A01 CSCL 06B

This is the seventh issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 29 papers recently published in Russian language periodicals and bound collections and of 8 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. Additional features include two interviews with the Soviet Union's cosmonaut physicians and others knowledgable of the Soviet space program. The topics discussed at a Soviet conference on problems in space psychology are summarized. Information about English translations of Soviet materials available to readers is provided. The topics covered in this issue have been identified as relevant to 29 areas of aerospace medicine and space biology. These areas are adaptation, biospherics, body fluids, botany, cardiovascular and respiratory systems, developmental biology, endocrinology, enzymology, exobiology, genetics, habitability and environment effects, hematology, human performance, immunology, life support systems, mathematical modeling, metabolism, microbiology, morphology and cytology, musculoskeletal system, neurophysiology, nutrition, perception, personnel selection, psychology, radiobiology, and space medicine. Author

N86-32084# Texas Univ., Dallas. Center for communication Disorders.
A CHINCHILLA RESTRAINT SYSTEM
C. E. Hargett, Jr., James H. Patterson, Jr., Dennis L. Curd, Melvin Carrier, Jr., and Ilia M. L. Gautier Jan. 1986 25 p
(Contracts DAMD17-80-C-0109; DA Proj. 3M6-1102-BS-10)
(AD-A167408; USAARL-86-1) Avail: NTIS HC A02/MF A01 CSCL 06/10

In studies of noise-induced hearing loss in chinchillas, it is necessary to restrain the animal in a known noise field for the duration of the exposure. In studies of continuous noise effects, a small cage in which the subject is free to move about has been used. The orientation of the subject due to the omnidirectional nature of continuous noise effects is not critical due to the omnidirectional nature of the exposure. In contrast, freefield impulse noise is a highly directional sound field by its essential nature. The need to restrain the research subject and fix its orientation relative to the source of the impulse is critical in impulse noise exposures. Only three references were found in the literature about chinchilla restraining devices. These devices were applicable more for routine clinical procedures, administering medication, detecting motion, and collecting motion, and collecting semen for reproduction studies. None were suited for auditory research. This led us to develop the chinchilla restraint system (CRSS). The function of

the CRS is to maintain a chinchilla in a stable, immobile position which can be standardized for all subjects during studies of noise-induced hearing loss. The CRS accomplishes this using the chinchilla's own natural tendencies as a burrowing creature. The CRS provides an artificial burrow in which a chinchilla seems content to remain quiet for extended periods. This report details the design and use of the CRS. GRA

N86-32085# Nevada Univ., Reno. Desert Research Inst.
GAS EXCHANGE CHARACTERISTICS OF LEAVES AS INDICATORS OF THE BASIC LIMITATIONS TO THE RATE OF PHOTOSYNTHESIS Annual Report, 1 Jun. 1985 - 31 May 1986
T. D. Sharkey 1986 4 p
(Contract DE-FG08-84ER-13234)
(DE86-009632; DOE/ER-13234/2; AR-2) Avail: NTIS HC A02/MF A01

The response of photosynthesis to light, CO2 and O2 is studied by measuring the exchange of gases (water vapor and CO2) between the atmosphere and the leaf. These measurements are combined with measurements of metabolite levels and enzyme activities which can disclose the molecular events which limit or regulate the rate of photosynthesis. The purpose of this research is to identify the underlying molecular events which give rise to easily measured photosynthetic characteristics so that those processes which are most important in regulating or limiting photosynthesis in leaves can be identified. A significant result of this research has been the identification of the cause of O2 insensitive photosynthesis in C3 plants. It has been determined that this anomalous behavior is caused by deactivation of the primary carboxylating enzyme, RuBP carboxylase, in low O2. It is believed that this deactivation occurs because the plant is unable to use all of the products of photosynthesis that could be made if deactivation did not occur. Current efforts are directed toward understanding how this deactivation may be advantageous to the plant and how rapidly it can occur. DOE

N86-32086# Florida State Univ., Tallahassee.
GUARD CELL BIOCHEMISTRY: RESPONSE TO ENVIRONMENTAL STIMULI CAUSING CHANGES IN GAS EXCHANGE
W. H. Outlaw, Jr. 1986 24 p
(Contract DE-AS05-81ER-10803)
(DE86-010287; DOE/ER-10803/5) Avail: NTIS HC A02/MF A01

Our understanding of how the light reactions of photosynthesis influence carbon metabolism in guard cells is rudimentary. This state of affairs is understandable; reliable reports of PS II in guard cells were published only two years ago. At this point, I wish to warn against complacency in drawing strict analogies between guard cell chloroplast function and that in other cells. In general, guard cell chloroplasts and their mesophyll counterparts differ in morphology, for example, the guard cell organelles are smaller, less abundant, and paler, have fewer thylakoids/granna, have areas of peripheral reticulum, and contain relatively more starch. One biochemical difference underlying these morphological ones has already been identified (fluorescence kinetics). DOE

N86-32087# European Space Agency, Paris (France).
INFLUENCE OF GRAVITY ON STRUCTURE AND BEHAVIOR OF PARAMECIUM CAUDATUM
Ruth Hemmersbach Mar. 1986 69 p
(ESA-TT-963; DFVLR-FB-85-40; ESA-86-98077) Avail: NTIS HC A04/MF A01; German version avail. from DFVLR, Cologne, West Germany DM 27

Paramecium caudatum was used to study the behavior of the contractile vacuolar system, the nutrient uptake, cyclose, multiplication rate, and ultrastructure under simulated weightlessness using a fast-running clinostat and a modified agar method. In comparing 0 and 1 g behavior, no modification is detected, except for the vacuolar system. The slowed and irregular functioning behavior of the contractile vacuolar system due to an inner timing modification is influenced by gravity. Negative geotaxis of Paramecium caudatum is not confirmed. The effects of gravity on the vacuole formation, situation, and number cannot be determined. ESA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-32088* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 288)
1986 69 p
(NASA-SP-7011(288); NAS 1.21:7011(288)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 190 reports, articles and other documents introduced into the NASA scientific and technical information system in August 1986. Author

N86-32089# Technion - Israel Inst. of Tech., Haifa.
A 24-HOUR STRUCTURE OF VIGILANCE UNDER PROLONGED SLEEP DEPRIVATION: RELATIONSHIP WITH PERFORMANCE Final Report, Feb. 1983 - Feb. 1984
Peretz Lavie Mar. 1986 72 p
(Contracts DAJA45-83-C-0047; DA Proj. 2Q1-61102-B-74-D)
(AD-A167399; ARI-RN-86-32) Avail: NTIS HC A04/MF A01 CSCL 06/19

The present study investigated the 36h structure of sleepiness and its relationship with psychomotor performance after 28h of sleep deprivation. Eight subjects, aged 19 to 25 years, participated after spending two adaptation nights in the sleep lab at 2300 and remained deprived of sleep until 1100. At 1100 a schedule of either 7 min sleep attemp in bed, 13 min awake outside the bedroom, or 7 min resisting sleep in bed, 13 min awake outside the bedroom, was begun and maintained for 36h until 23h on the next day. The order of the two experimental conditions, which were separated by two weeks, was counterbalanced. Polyhypnographic recordings were carried out during the 7-min in bed periods, and psychomotor testing (one and two-handed reaction time tasks) was conducted in the middle of the 13-min wake periods. Significant circadian effects were found for the two components of the psychomotor performance: reaction time and movement time. In spite of the great similarity between the circadian variations in sleepiness and the circadian variations in performance, correlating these two variables for 12h blocks revealed random and nonsignificant correlations. This negated a causal relationship between the amount of sleepiness and performance, and suggests that both are modulated by a common underlying circadian oscillator. GRA

N86-32090# Aerospace Medical Div., Brooks AFB, Tex.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT, AEROSPACE MEDICAL DIVISION, FY 1987 Annual Report, Jun. 1985 - Jan. 1986
Jan. 1986 25 p
(AD-A167422; AMD-TR-86-001) Avail: NTIS HC A02/MF A01 CSCL 05/8

This TOD describes the planning methodology used within two of AMD's laboratories to achieve our technical goals. Specifically, efforts are directed in the biotechnology program to man's adaptability, survivability, and performance capabilities within his operational environment. This research and development of AMD's functions is accomplished as interdisciplinary work by teams of biomedical scientists, engineers, and physical scientists within the Air Force laboratories and the industrial and academic communities. GRA

N86-32091# Army Research Inst. of Environmental Medicine, Natick, Mass.
ALTITUDE ACCLIMATIZATION (VENTILATION AND CHEMORESPONSIVENESS) DURING WAKEFULNESS AND SLEEP
David P. White, Kevin Gleeson, Cheryl K. Pickett, John T. Reeves, and Anne M. Rannels Apr. 1986 29 p
(AD-A167738; USARIEM-M-28/86) Avail: NTIS HC A03/MF A01 CSCL 06/19

Although the influence of altitude acclimatization on respiration has been carefully studied, the associated changes in hypoxic

and hypercapnic ventilatory responses are the subject of controversy and neither response has been carefully evaluated during sleep at altitude. To answer these questions, six healthy males were studied at sea level and on nights 1, 4, and 7 following arrival at altitude (14,110 ft). During wakefulness ventilation and the ventilatory responses to hypoxia and hypercapnia were determined on each occasion. During both NREM and REM sleep at sea level and on all three nights at altitude, ventilation and the hypercapnic ventilatory response were measured. With acclimatization to high altitude, ventilation increased during both wakefulness and sleep which reflected primarily increasing respiratory frequency. The slope of the hypercapnic response did not rise further with acclimatization although the position of this response shifted significantly to the left during wakefulness and sleep. Finally, sleep induced similar decrements in both ventilation and hypercapnic responsiveness at altitude to those seen at sea level. GRA

N86-32092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIAL FEATURES OF SURGICAL INTERVENTION UNDER CONDITIONS OF WEIGHTLESSNESS
G. L. Yaroshenko, V. G. Terentyev, and M. N. Mokrov 7 May 1986 11 p Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal (USSR), no. 10, Oct. 1967 p 69-70
(AD-A167916; FTD-ID(RS)T-0294-86) Avail: NTIS HC A02/MF A01 CSCL 22/1

At present questions of medical support of prolonged space flights acquire fundamental importance. Among these questions together with forecasting of the probable morbidity of cosmonauts urgent/actual is the determination of the possibility of executing of medical manipulations, including surgical intervention under the conditions of weightlessness. It is possible to make following conclusions: Execution of surgical intervention under conditions of weightlessness is possible and is not connected with great difficulties; The probability of pulverizing/atomizing biological fluids, which are located under relatively greater pressure (for example, arterial blood) should be considered; For preventing the pollution/contamination of the atmosphere of the cab during the dissection of tissues, rich in vessels, it is desirable to use hemostatic forceps. Local anesthesia in null gravity is shown. With autopsy of peritoneum strengthening of eventration of intestine is observed. Therefore the autopsy of peritoneum should be conducted step by step, minimally limiting the length of section/cut. With the filling of a syringe with medical solutions, intended for intravenous introduction, one should thoroughly track so that together with solution the air would not fall. GRA

N86-32093# National Aerospace Medical Centre, Soesterberg (Netherlands).
[ACTIVITIES REPORT ON PHYSICAL AND PSYCHOLOGICAL HEALTH OF FLYING PERSONNEL] Annual Report, 1983 [JAARVERSLAG 1983]
1984 45 p In DUTCH
(ESA-86-97385) Avail: NTIS HC A03/MF A01

Activities concerning the physical and psychological health of flying personnel are summarized. A human centrifuge; anthropometric measurements on adolescents; F-16 pilot EEG's; and motion perception sensations with peripherically offered visual stimuli are discussed. Research was done on Meniere patients and rheoencephalographics. Computerized psychodiagnostic methods for pilot and driver aptitude judgements were developed. Airbus cockpit certification methods were evaluated. ESA

N86-32094# National Aerospace Medical Centre, Soesterberg (Netherlands).
[ACTIVITIES REPORT ON PHYSICAL AND PSYCHOLOGICAL HEALTH OF FLYING PERSONNEL] Annual Report, 1984 [JAARVERSLAG 1984]
1985 39 p In DUTCH
(ESA-86-97386) Avail: NTIS HC A03/MF A01

Activities concerning the physical and psychological health of flying personnel are summarized. A hybobaric chamber and human centrifuge are described. Prevention of blood pressure increase of pilots was examined. Possibilities of the body to increase acceleration tolerance, and relevant training mechanisms, were studied. Studies on vision and hearing were carried out. A psychodiagnostical investigation and test method useful for drivers was developed. ESA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-32095# Shape Technical Center, The Hague (Netherlands). Operations Research Div.
USE OF ARTIFICIAL INTELLIGENCE AND PSYCHOLOGY IN THE ANALYSIS OF COMMAND AND CONTROL
J. T. Dockery and J. vandenDriessche Feb. 1985 272 p
(Contract STC-80-5/I)
(STC-TM-749; ESA-86-97393) Avail: NTIS HC A12/MF A01

The psychological profile and behavior of a military decision maker under stress were studied. Use of a systems simulation language to study reactions in air defense situations was assessed. For individual titles, see N86-32096 through N86-32097.

N86-32096# Shape Technical Center, The Hague (Netherlands). Operations Research Div.
THE PSYCHOLOGY OF DECISION MAKING
In its Use of Artificial Intelligence and Psychology in the Analysis of Command and Control Feb. 1985 p 1-61 (For primary document see N86-32095 23-53)
Avail: NTIS HC A12/MF A01

A psychological profile of a military commander under stress is outlined. Information processing states for a decision-maker under stress are introduced. Bias and processing of information are discussed. Descriptive decision-making rather than normative decision making is used to describe the commander. ESA

N86-32097# Shape Technical Center, The Hague (Netherlands). Operations Research Div.
ARTIFICIAL INTELLIGENCE AND THE RULE ORIENTED SYSTEM SIMULATION (ROSS) LANGUAGE
In its Use of Artificial Intelligence and Psychology in the Analysis of Command and Control Feb. 1985 p 62-262 (For primary document see N86-32095 23-53)
Avail: NTIS HC A12/MF A01

The use of the Rule Oriented System Simulation language (which unites concepts of artificial intelligence and event step simulation in an object oriented simulation language) in an air defense simulation; a purely psychological experiment on the computer; and a simulation of engagement decision logic in an air defense battalion operations center with a fuzzy set logic program is described. Ideas on joining artificial intelligence and catastrophe theory are discussed. The latter is used as a source of decision rules. The classical ambush situation is analyzed. ESA

N86-32098# Rochester Inst. of Tech., N. Y. Dept. of Electrical Engineering.
SPEECH ANALYSIS BASED ON A MODEL OF THE AUDITORY SYSTEM Final Report, Oct. 1983 - Sep. 1985
Harvey E. Rhody, Robert A. Houde, Charles W. Parkins, and Sohlel Dianat Feb. 1986 54 p
(Contract F30602-81-C-0169)
(AD-A167426; RADC-TR-85-265) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report describes a signal processing technique for speech signals based on a model of the processing done in the auditory system. It has been found that the click response of the auditory system is an exponential function. The spectrogram produced by a speech waveform that has been windowed by the same function possesses excellent resolution of both time and frequency parameters of the signal. It is expected that this analysis method will improve the discrimination of phonemic elements, and will

prove useful in such applications as speech recognition and speech compression. GRA

N86-32099# European Space Agency, Paris (France).
SPEED OF WORK AND ERROR RATE: ANALYSES OF INDIVIDUAL DIFFERENCES IN A CHOICE REACTION SERIES WITH A COGNITIVE COMPONENT
Klaus-Martin Goeters Dec. 1985 23 p Original language document was announced as N86-10781
(ESA-TT-944; DFVLR-FB-85-21; ESA-86-97579) Avail: NTIS HC A02/MF A01; original German version available from DFVLR, Cologne, West Germany DM 10.50

A visual choice reaction test with a cognitive component was introduced to measure response processes in more detail than is possible with summarizing scoring of paper pencil tests. For each reaction the following information was registered: stimulus (light) reaction (right/wrong), reaction time, and omission (yes/no). Each subject had to react on 320 successive signals without pause. From the reaction protocol of each subject indices for speed of work, oscillation of performance, error disposition, and reaction inhibition were computed. The main results is that in this reaction test speed of work and error disposition are not coupled. Errors are not a consequence of quick reactions. The observed errors seem to be the expression of an increased variation in performance. The results are discussed with a view to a psychophysiological model of activation. ESA

N86-32100# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Experimental Psychology Group.
AUDITORY VERSUS VISUAL SELECTIVE-ATTENTION TASKS
L. C. Boer and M. H. B. Ruzius Oct. 1985 27 p
(Contract A83/K/045)
(IZF-1985-19; TDCK-93575; ESA-86-98043) Avail: NTIS HC A03/MF A01

The Dichotic Listening Task (DLT) of Gopher and Kahnemann (1971), which requires subjects to detect targets occurring in one of two messages while ignoring the other, was compared with the Rapid Serial Visual Presentation (RSVP) based on a paradigm of Sperling and Reeves (1980). Subjects were required to detect targets occurring in one of two letter streams while ignoring the other. The performance on DLT and RSVP correlate, but not beyond the basic level between any pair of information processing tasks. Suggestions for RSVP modifications emphasizing selective-attention requirements are considered. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-32101*# Wisconsin Univ., Madison. Dept. of Horticulture.
CONTROLLED ENVIRONMENT LIFE SUPPORT SYSTEM: GROWTH STUDIES WITH POTATOES
T. W. Tibbitts and R. M. Wheeler Mar. 1986 52 p
(Contract NCC2-301)
(NASA-CR-177400; NAS 1.26:177400) Avail: NTIS HC A04/MF A01 CSCL 05H

Results of experiments conducted to maximize the productivity of potatoes grown under controlled environmental conditions are discussed. A variety of parameters is examined which affect potato growth, specifically, photoperiod, light intensity, temperature, nitrogen nutrition, carbon dioxide concentration and culture techniques. These experiments were conducted using five different cultivars, Russet Burbank, Norchip, Superior, Kennebec and Norland. To achieve high productivity, three specific objectives were explored: (1) to develop effective cultural procedures, (2) to determine the most effective photoperiod and (3) to develop a mist culture system. It is felt that the productivity obtained in this study is below the maximum that can be obtained. High irradiance levels coupled with tuber-promoting conditions such as cooler temperatures, increased CO2 levels and lowered nitrogen concentrations should allow increases in tuber production. Tuberization appears to be accelerated by short daylengths although final yields are not increased. Mist culture techniques have not yet produced fully developed tubers. The use of supporting media and alteration of the nitrogen content of the mist solution are being explored as a way to allow tubers to develop to maturity. Author

N86-32102*# National Aeronautics and Space Administration, Washington, D.C.
NASA FACTS: SPACE SHUTTLE FOOD SYSTEMS
1986 15 p
(NF-150/1-86) Avail: Issuing Activity CSCL 06H

On the Space Shuttle, the food is prepared at a galley installed on the Orbiter's mid-deck. The galley is a modular unit that can be removed for special weight-critical missions or missions that require extra interior space. It contains a personal hygiene station, a water dispenser, an oven, condiment and meal tray stowage, and a food preparation area. Foods are individually packaged and stowed for easy handling in the zero gravity of space. All food is precooked or processed so it requires no refrigeration and is either ready to eat or can be prepared simply by adding water or heating. The only exception is the fresh fruit and vegetables stowed in the fresh food locker. The supplies consist of rehydratable food and beverages, thermostabilized food, intermediate moisture foods, natural form foods, irradiated meats, and condiments. A sample menu is also included. B.G.

N86-32103# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ABSOLUTE JUDGMENT VERSUS ABSOLUTE MAGNITUDE ESTIMATION TO CONVEY INFORMATION THROUGH SYMBOL MAGNITUDE CHANGES IN CRT DISPLAYS M.S. Thesis
Bernard Asiu Dec. 1985 75 p
(AD-A167059; AFIT/CI/NR-86-38T) Avail: NTIS HC A04/MF A01 CSCL 09/4

Psychophysical scaling of symbol magnitude to convey information through CRT displays was evaluated in terms of information theory. Series of lines and ellipses each with four, eight and twelve intermediate sizes were presented to twelve subjects under absolute judgment scaling and to an additional twelve subjects under absolute magnitude estimation scaling. Under absolute judgment, information transmission is higher and equivocation and ambiguity measures are lower than those obtained under absolute magnitude estimation. The difference in information transmission represents an increase of about one stimulus alternative under absolute judgement scaling and in itself does not preclude the practical application of absolute magnitude estimation to encode information. Rather it is the wide variability in median magnitude estimations that makes it difficult to reach any common ground for symbol interpretation. Author (GRA)

N86-32104# Georgia Inst. of Tech., Atlanta. Center for Man-Machine Systems Research.
HUMAN PROBLEM SOLVING IN FAULT DIAGNOSIS TASKS Final Report, Jul. 1979 - Jul. 1982
William B. Rouse and Ruston M. Hunt Apr. 1986 55 p
(Contracts MDA903-79-C-0421; DA Proj. 2Q1-61102-B-74-F)
(AD-A167397; ARI-RN-86-33) Avail: NTIS HC A04/MF A01 CSCL 05/10

This report evaluates the nature of human problem solving abilities specifically related to fault diagnosis situations. Three types of fault diagnosis were analysed involving diagnosis utilizing both real equipment and computer simulated equipment failures. In addition, the investigators experimented with computer generated problem solving aids to supplement human decision making capacities in diagnostic tasks. Results of the initial investigation indicate that human problem solving tends to be highly context-specific but that pattern recognition capabilities are exceptional allowing for a high degree of accuracy in ambiguous problem solving situations. Both structured-oriented and strategy-oriented problem solving aids were analysed. Structured-oriented bookkeeping aids clearly improved performance, while strategy-oriented aids actually had a negative effect on transfer of training. This research

effort is clearly relevant to military interests in effective training of optimal decision making in sub-optimal conditions. The results strongly support further research into the nature and training of effective solving. GRA

N86-32105# Lawrence Livermore National Lab., Calif.
STRIVING FOR NATURAL USAGE
N. A. Storch 1986 9 p Presented at the ACM/SIGCHI '86: Human Factors in Computing Systems, Boston, Mass., 16 Apr. 1986
(Contract W-7405-eng-48)
(DE86-009402; UCRL-94415; CONF-8604159-1) Avail: NTIS HC A02/MF A01

During the past year, the Non-Destructive Evaluation Section has supported developing a user environment for their technicians and scientists who do image processing and analysis of images obtained from various sources. In particular, this has involved bringing together certain software tools which already existed into a prototype, trying to understand user needs by observation, discussion, insightful guessing, and then continuing on to build something better. One of the primary goals has been to achieve a natural user interface. The efforts have required internal complexity in handling: pointing of the user to the image or screen and resultant actions, device independent graphics and raster operations, application menus, working image data base and command recognition. These are, for the most part, independent of the image processing functions. Starting from broad, not very well defined requirements, it has become an on-going effort to checkout both interactive and image processing operations. A framework was developed to allow for flexibility in image processing operations and their integration into work-related applications. The results indicate that success in accomplishing an easy, natural usage is due to: commitment and concentration on usage, continual reevaluation during development, and allowance for the overhead of tidying up to maintain internal order and clarity. DOE

N86-32106# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
CONTROL THEORETIC ANALYSIS OF HUMAN OPERATOR MEDIATED RENDEZVOUS AND DOCKING
P. Milgram and P. H. Wewerinke 26 Feb. 1985 10 p Presented at 2nd IFAC/IFIP/IFORS/IEA Conf. on Analysis, Design and Evaluation of Man-Machine Systems, Varese, Italy, 10-12 Sep. 1985
(NLR-MP-85020-U; B8661085; ESA-86-97669) Avail: NTIS HC A02/MF A01

A model based analysis of manual control of space rendezvous and docking in the presence of transmission time delays (nominal case: human operator (HO) on the ground) is presented. The variables studied are time delay, human induced motor noise levels, rotational and translational control and the effect of display prediction. An envelope of performance is estimated, bounded by performance with optimal prediction and performance with no prediction at all. Nominal performance for a simple second order Taylor predictor display is estimated. An HO imperfect internal representation of the system is used to model the no-predictor and predictor display cases. ESA

N86-32107# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
CONTROL LOOPS WITH HUMAN OPERATORS IN SPACE OPERATIONS. PART 1: HUMAN ENGINEERING ANALYSIS, SYNTHESIS AND EVALUATION TECHNIQUES Final Report
P. Milgram, R. C. vandeGraaff, and P. H. Wewerinke Paris ESA 17 May 1985 280 p
(Contract ESA-5594/83)
(NLR-TR-84116-L-Pt-1; ESA-CR(P)-2190-Pt-1; ESA-86-97787-Pt-1) Avail: NTIS HC A13/MF A01

Human engineering approaches and methodologies applicable for analysis of performance of human-machine systems, particularly space teleoperator applications, are reviewed. Motivated by the presumed active role of the human operator in future space teleoperation missions, the application of human engineering within the various stages of system development is discussed, emphasizing the impact on the development cycle of being able to analyze various aspects of human-in-the-loop system performance. Experimental and theoretical approaches to human performance analysis are identified. Fundamental and practical aspects of each approach are outlined. A modeling approach for the analysis of a specific class of supervisory space teleoperator missions is proposed. Human-computer task allocation for such missions is considered. ESA

N86-32108# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
CONTROL LOOPS WITH HUMAN OPERATORS IN SPACE OPERATIONS. PART 3: RENDEZVOUS AND DOCKING OPERATIONS AND MODEL ANALYSIS OF PERFORMANCE WITH HUMAN-IN-THE-LOOP Final Report
P. Milgram, P. Th. L. M. vanWoerkom, and P. H. Wewerinke Paris ESA 7 Dec. 1984 192 p
(Contract ESA-5594/83)
(NLR-TR-84116-L-Pt-3; ESA-CR(P)-2190-Pt-3; ESA-86-97789-Pt-3) Avail: NTIS HC A09/MF A01

Human-in-the-loop rendezvous and docking (RVD) performance was analyzed to demonstrate the practicality of applying engineering methods and techniques to the analysis of control loops with human operators in space operations. The RVD space segment and the related autonomous operations are described. Model analyses of RVD performance in the final approach phase, for the case in which the human operator is involved in manual control of RVD, and for the case in which the human operator is monitoring an automated RVD for the occurrence of failures are given. ESA

N86-32109# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
CONTROL LOOPS WITH HUMAN OPERATORS IN SPACE OPERATIONS. PART 4: RESEARCH REQUIREMENTS FOR HUMAN-IN-THE-LOOP SPACE TELEOPERATOR DEVELOPMENT Final Report
P. Milgram Paris ESA 17 May 1985 62 p
(Contract ESA-5594/83)
(NLR-TR-84116-L-Pt-4; ESA-CR(P)-2190-Pt-4; ESA-86-97790-Pt-4) Avail: NTIS HC A04/MF A01

Short-term human engineering research requirements for developing rendezvous and docking and space telemanipulation capabilities are presented. A catalog of research topics related to human-in-the-loop teleoperation performance is given. Available resources for model analytical investigation of these research topics and resources for the establishment of an initial human performance research laboratory for carrying out such investigations and for testing proposed design concepts by ESA are reviewed. ESA

N86-32110# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
CONTROL LOOPS WITH HUMAN OPERATORS IN SPACE OPERATIONS. PART 5: EXECUTIVE SUMMARY Final Report
Paul Milgram Paris ESA 17 May 1985 157 p
(Contract ESA-5594/83)
(NLR-TR-84116-L-Pt-5; ESA-CR(P)-2190-Pt-5; ESA-86-97791-Pt-5) Avail: NTIS HC A08/MF A01

Human engineering analysis, synthesis, and evaluation techniques; robotics operations and manual control experiments; spacecraft rendezvous and docking operations and model analysis of performance with human-in-the-loop; and ESA research requirements for human-in-the-loop space teleoperator development are discussed. ESA

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

N86-32111*# State Univ. of New York, Binghamton. Dept. of Biological Sciences.

EVALUATION OF THE NEED FOR A LARGE PRIMATE RESEARCH FACILITY IN SPACE
Frank M. Sulzman 1986 50 p
(Grant NAG2-232)
(NASA-CR-179661; NAS 1.26:179661) Avail: NTIS HC A03/MF A01 CSCL 06B

In the summer of 1983, an advisory committe was organized that would be able to evaluate NASA's current and future capabilities for nonhuman primate research in space. Individuals were chosen who had experience in four key research areas: cardiovascular physiology, vestibular neurophysiology, musculoskeletal physiology, and fluid and electrolyte balance. Recommendations of the committee to NASA are discussed. B.G.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N86-32112*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTIPLE GRID PROBLEMS ON CONCURRENT-PROCESSING COMPUTERS
D. Scott Eberhardt (Stanford Univ., Calif.) and Donald Baganoff Feb. 1986 114 p
(NASA-TM-86675; A-85103; NAS 1.15:86675) Avail: NTIS HC A06/MF A01 CSCL 09B

Three computer codes were studied which make use of concurrent processing computer architectures in computational fluid dynamics (CFD). The three parallel codes were tested on a two processor multiple-instruction/multiple-data (MIMD) facility at NASA Ames Research Center, and are suggested for efficient parallel computations. The first code is a well-known program which makes use of the Beam and Warming, implicit, approximate factored algorithm. This study demonstrates the parallelism found in a well-known scheme and it achieved speedups exceeding 1.9 on the two processor MIMD test facility. The second code studied made use of an embedded grid scheme which is used to solve problems having complex geometries. The particular application for this study considered an airfoil/flap geometry in an incompressible flow. The scheme eliminates some of the inherent difficulties found in adapting approximate factorization techniques onto MIMD machines and allows the use of chaotic relaxation and asynchronous iteration techniques. The third code studied is an application of overset grids to a supersonic blunt body problem. The code addresses the difficulties encountered when using embedded grids on a compressible, and therefore nonlinear, problem. The complex numerical boundary system associated with overset grids is discussed and several boundary schemes are suggested. A boundary scheme based on the method of characteristics achieved the best results. M.G.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N86-32113# Information Systems and Technology Center, Wright-Patterson AFB, Ohio. Ada Validation Facility.
ADA (TRADE NAME) COMPILER VALIDATION SUMMARY REPORT: VERDIX CORPORATION VERDIX ADA DEVELOPMENT SYSTEM, VERSION 5.2 FOR THE TEKTRONIX 6130 UNDER UTEK, RELEASE 2.1.1 Report for 16 Nov. 1985 - 16 Nov. 1986
16 Nov. 1985 76 p
(AD-A166872; AVF-VSR-16.0286) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Validation Summary Report presents the results and conculsions of testing performed on the Verdi Ada Development System (VADS), Version 5.2. Standardized tests serve as input to an Ada (trade name) compiler, producing results which are evaluated by the validation team. This summary briefly states the highlights of the VADS, Version 5.2, validation. On-site testing was performed on 14 Nov 1985 through 16 Nov 1985 at Verdix Corporation in Aloha, Oregon under the auspices of the Ada Validation Facility (AVF), according to Ada Validation Office (AVO) policies and procedures. The VADS, Version 5.2, is hosted on a Tektronix 6130 operating under UTek Operating System, Release 2.1.1. The suite of tests known as the Ada Compiler Validation Capability (ACVC), Version 1.6, was used. The ACVC is used to validate conformance for a compiler to ANSI/MIL-STD-1815A Ada. The purpose of testing is to ensure that a compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behavior that is implementation dependent but permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, or during execution. GRA

N86-32114# Information Systems and Technology Center, Wright-Patterson AFB, Ohio.
ADA (TRADE NAME) COMPILER VALIDATION SUMMARY REPORT: TELESOFT, INC. TELESOFT ADA, VERSION 2.39 GOULD PS3000 HOST, GOULD CONCEPT/32 (TRADE NAME) MODEL 6750 TARGET Report, 8 Nov. 1985 - 8 Nov. 1986
8 Nov. 1985 70 p
(AD-A167470; AVF-VSR-13.0386) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Validation Summary Report presents the results and conclusions of testing performed on the TeleSoft Ada compiler, Version 2.39. Standardized tests serve as input to an Ada compiler, producing results which are evaluated by the validation team. This summary briefly states the highlights of the TeleSoft Ada Compiler, Version 2.39 validation. The suite of tests known as the Ada Compiler Validation Capability (ACVC), Version 1.6, was used. The ACVC is used to validate conformance of a compiler to ANSI/MIL-STD-1815A Ada. The purpose of testing is to ensure that a compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behavior that is implementation dependent but permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, or during execution. GRA

N86-32115# Naval Postgraduate School, Monterey, Calif.
THE RISC (REDUCED INSTRUCTION SET COMPUTER) ARCHITECTURE AND COMPUTER PERFORMANCE EVALUATION M.S. Thesis
Manuel F. P. deBarros Mar. 1986 97 p
(AD-A167873) Avail: NTIS HC A05/MF A01 CSCL 09/2

A definition of Reduced Instruction Set Computers is developed. A computer performance model which allows the evaluation of architectural alternatives is presented. An example on the use of the model to compute the performance altenatives for a given application is presented to study the effect of the addition of an instruction to a processor instruction set. Author (GRA)

N86-32116# Naval Postgraduate School, Monterey, Calif.
A 32-BIT MICROPROCESSOR BASED SOLID STATE DATA RECORDER FOR SPACE BASED APPLICATIONS M.S. Thesis
Thomas J. Frey, Jr. Mar. 1986 76 p
(AD-A167887) Avail: NTIS HC A05/MF A01 CSCL 14/3

A need exists for non-volatile, reliable and radiation hardened mass data storage devices for space applications. Tape recorders modified for use in the space environment have proven both expensive and unreliable. The use of magnetic bubble memory as a recording medium in recent space projects offers a promising

alternative to tape recorders. This thesis develops the design of a 32-bit microprocessor based advanced solid state data recorder for space based applications utilizing two-megabyte magnetic bubble memory boards and the storage medium. GRA

N86-32117# Lanchester Polytechnic, Coventry (England). Dept. of Systems and Control.
STABILITY CONSIDERATIONS IN THE DESIGN OF SIGMA-DELTA MODULATORS
C. P. Lewis, M. I. Mathew, and A. M. Zikic 1985 10 p
(S-and-C.85-1; ESA-86-97257) Avail: NTIS HC A02/MF A01

A design technique based on the use of z-transform modeling of nonlinear elements transformed into the w-domain was applied to the study of sigma-delta modulators, used in the generation of tracking analog to digital converters. Results show that the w-domain techniques allied to the use of suitable describing function models facilitate the design of sigma-delta modulators. To assist in the maximization of the yield of a system when fabricated, it is essential to use computer design aids for the easy identification of important system parameters and the effect of their variation on system performance. A computer aided design package for this procedure was written. ESA

N86-32118# Institut National Polytechnique, Grenoble (France).
TOP-DOWN DESIGN OF VLSI MICROPROCESSORS Ph.D. Thesis [CONCEPTION DESCENDANTE APPLIQUEE AUX MICROPROCESSEURS VLSI]
Francois Bertrand 1985 246 p In FRENCH; ENGLISH summary
(ESA-86-97299) Avail: NTIS HC A11/MF A01

An approach based on classical specification and refinement methods to minimize the probability of VLSI design error and to optimize the design choice is presented. The study is supported by the design and implementation of the 80C48 VLSI microprocessor. The main design steps considered include choice of the computation algorithm, choice of the data path, and choice of the control structure. Analysis and simulation are used to validate the design steps. The optimization of the design is partially based on a predictive evaluation. It is shown that a design based on rather large building blocks is advantageous. These functional blocks can be developed, implemented and tested by automatic procedures. ESA

N86-32119# Amsterdam Univ. (Netherlands). Dept. of Mathematics and Computer Science.
THE SECOND MACHINE CLASS 2: AN ENCYCLOPEDIC VIEW OF THE PARALLEL COMPUTATION THESIS
Peter vanEmdeBoas Dec. 1985 27 p Presented at Stefan Banach International Mathematical Center 26th Semester on Mathematical Problems in Computation Theory, Warsaw, Poland, 16 Sep.-14 Dec. 1985
(FVI-85-14; ESA-86-98070) Avail: NTIS HC A03/MF A01

The parallel computation thesis, which states that polynomial time on a parallel machine equals polynomial space on a sequential device is discussed. This thesis is not an absolute truth for parallel models. It characterizes a specific, frequently observed species of parallelism. The thesis is illustrated by explaining why it holds for a number of models, and by presenting models for which the thesis is likely to fail. ESA

N86-31953# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
NEW ARRAY PROCESSORS OF FLOATING POINT SYSTEMS [NEUE ARRAY-PROZESSOREN VON FLOATING POINT SYSTEMS]
Bernd Lauer *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 101-105 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

N86-32131# Technische Univ., Berlin (West Germany).
MACHINE LEARNING IN METAXA [MASCHINELLES LERNEN IN METAXA]
Werner Emde *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 87-115 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-32120 CIAD, Zoetermeer (Netherlands).
TEST OF THE SYSTEM MICRO AIDED ENGINEERING (MAE) CAD/CAM [SYSTEEMTEST MAE CAD/CAM]
B. G. Luttikhuizen and J. J. Duivenvoorden 1985 37 p In DUTCH
(A-15; ISBN-90-6818-021-5; ESA-86-97765) Copyright. Avail: Issuing Activity

A computer aided design (CAD) - computer aided manufacturing (CAM) modular package was tested. The system is suited for mechanical engineering applications. The hardware and software test configurations are described. After base-figure construction, two-dimensional design manipulations, transformations, reflections, rotations, reductions, and rescalings were executed. Line-strings, edgings, parameterized forms, accuracy, design speed, data storage efficiency, coupling possibilities with FORTRAN programs, and data base management system performance were investigated. An engine, a T-piece with flanges, and a ship's plating were modeled in three dimensions and combined. The two and three-dimensional integration was examined. For numerical control, pump-cylinder elaborations were executed. The package is attractive for a large number of mechanical engineering applications, with certain restrictions. ESA

N86-32121# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
CWI NEWSLETTER, NO. 8 Quarterly Issue, Sep. 1985
Arjeh M. Cohen, ed., Richard D. Gill, ed., and Jo C. Ebergen, ed. Sep. 1985 53 p
(CWI-Newsletter-Issue-8; ISSN-0168-826X; ESA-86-97382) Avail: NTIS HC A04/MF A01

Karmarkars(1984) linear programming method and an algorithm for the factorization of polynomials are discussed. For individual titles, see N86-32122 through N86-32123.

N86-32122# Tilburg Univ. (Netherlands). Dept. of Econometrics.
THE NEW LINEAR PROGRAMMING METHOD OF KARMARKAR
A. Schrijver *In* Center for Mathematics and Computer Science CWI Newsletter, No. 8 Sep. 1985 p 2-14 (For primary document see N86-32121 23-61)
Avail: NTIS HC A04/MF A01

The Karmarkar (1984) polynomial time algorithm for linear programming, claimed to be 50 times faster than the simplex method, is discussed. It is shown that the method has polynomially bound run time. ESA

N86-32123# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
A RECENT ALGORITHM FOR THE FACTORIZATION OF POLYNOMIALS
Arjen K. Lenstra *In its* CWI Newsletter, No. 8 Sep. 1985 p 15-20 (For primary document see N86-32121 23-61)
Avail: NTIS HC A04/MF A01

A polynomial-time factoring algorithm is presented. Its run time, when applied to a polynomial f in Z(X), is always bounded by a fixed polynomial function of the degree and the coefficient-size of f. The irreducible factors in Z(X) of f can be regarded as the minimal polynomials (in Z(X)) of its roots. Therefore, to find an irreducible factor of f, it suffices to determine the minimal polynomial of one of its roots. The minimal polynomial of a root a of f

immediately follows from an integral linear combination of minimal degree among the powers of a. It is shown that the problem of finding such a relation among the powers of a can be reduced to the problem of finding a relatively short vector in a subset of a real vector space. Such a short vector can then be found by the basis reduction algorithm. ESA

N86-32124# Technische Univ., Berlin (West Germany). Fachbereich Informatik.
TEXT UNDERSTANDING: INTERESTINGNESS AS A BASIS FOR THE VARIATION OF THE ANALYSIS DEPTH Final Report, Dec. 1984
Hans-Jochen Schneider, Werner Emde, Michael Fuernsinn, Siegfried Guenther, Mohammed Khenkhar, James Kilbury, Kai vonLuck, Claus-Rainer Rollinger, Bernd Ruschkowski, and Albrecht Schmiedel Bonn, West Germany BMFT Dec. 1985 120 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-ID-85-001; ISSN-0170-8996; ESA-86-97435) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

Fundamental methods and procedures which enable computers to understand texts were investigated and developed. Aspects of the representation formalism in which natural language knowledge formulated as texts is to be represented were studied. This involved the representation of temporal and uncertain knowledge. The subsequent processing of the representations derived from texts as well as the dynamic construction of knowledge bases were investigaged in the framework of machine learning and nonmonotic deduction. The translation process that assigns a semantic representation to natural language utterances was treated using the Generalized Phrase Structure Grammar formalism. The relation between propositional versus analogical representation was investigated with respect to the solution of spatial problems in a geographical question-answering system. For individual titles, see N86-32125 through N86-32131.

N86-32125# Technische Univ., Berlin (West Germany).
THE SIMULATION OF NATURAL KNOWLEDGE SYSTEMS [ZUR SIMULATION NATUERLICHER WISSENSSYSTEME] c63
Claus-Rainer Rollinger *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 13-21 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

The representation formalism in which natural language knowledge is to be represented is discussed. The starting point of artificial intelligence is that intelligent behavior has to be knowledge-based behavior; the central questions are the representation or utilization of knowledge. Natural knowledge systems can be characterized via the human cognitive capabilities. Operational simulation models can be developed to formally represent knowledge, and to verify theories and hypotheses. The difficulties involved in the study of knowledge systems are outlined. The models are always defective since they do not adequately describe reality; therefore they have to be regularly corrected. Essential in the analysis of concrete knowledge systems is the structuring of knowledge into levels of different generality. ESA

N86-32126# Technische Univ., Berlin (West Germany).
TEXT UNDERSTANDING: INTERESTINGNESS AS A BASIS FOR THE VARIATION OF THE ANALYSIS DEPTH [TEXTVERSTEHEN: INTERESSENSGESTEUERTE VARIATION DER ANALYSETIEFE] c63
Claus-Rainer Rollinger and Hans-Jochen Schneider *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 23-30 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

Fundamental methods and procedures which enable computers to understand texts are reviewed The purpose of text understanding is to process the information by means of formal, operational methods and procedures and provide it to users or other processes. Methods must guarantee that the user only gets information which is relevant; the methods have to take into account users interest profiles. The status of science and research in the fields of text understanding and modeling of interest profiles is depicted. ESA

N86-32127# Technische Univ., Berlin (West Germany).
DIRECT PARSING USING IMMEDIATE DOMINANCE/LINEAR PRECEDENCE (ID/LP) GRAMMARS [DIREKTES PARSEN MIT ID/LP-GRAMMATIKEN]
James Kilbury *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 31-52 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

The utilization of ID/LP grammars for parsing as a linguistic process is discussed. The ID/LP grammar, a formalism developed in the framework of the Generalized Phrase Structure Grammar (GPSG), as well as the GPSG are introduced. The indirect parsing of ID/LP's whereby the external grammar is transformed into another kind of grammar, using Definite Clause Grammars is explained. The algorithms of Early and Shieber for recognition and parsing are presented. Open problems related to these algorithms are discussed. ESA

N86-32128# Technische Univ., Berlin (West Germany).
THE REPRESENTATION OF KNOWLEDGE FOR SITUATIONS AND EVENTS IN A DYNAMIC WORLD [WISSENSREPRAESENTATION FUER ZUSTAENDE UND EREIGNISSE IN EINER DYNAMISCHEN WELT] c63
Albrecht Schmiedel and Kai vonLuck *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 53-65 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

The representation of conceptual knowledge in order to construct an artificial epistemic subject using artificial intelligence is discussed. The emphasis is on a theoretical foundation for artificial systems which allow information exchange with a human user. The requirements for such a system are given. Formalisms for the representation of partial knowledge using abstract concepts and the dynamic construction of knowledge bases are presented. ESA

N86-32129# Technische Univ., Berlin (West Germany).
THE TEMPORAL ASPECT OF TEXT REPRESENTATION [ZUM ZEITLICHEN ASPEKT DER REPRAESENTATION VON TEXTEN]
Siegfried Guenther *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 67-86 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

The formal representation of natural language texts, and the summarizing and extraction procedure of this representation are discussed. This representation aims at weather report texts in which time plays an important role. Problems occurring in the representation are clarified by examples. A unified formalism using the concept of a time grid to solve these problems is presented. Other formalisms, starting from a set of temporal relations, are given. ESA

N86-32130# Technische Univ., Berlin (West Germany).
GEOSYS: A QUESTION-ANSWER SYSTEM WITH SPATIAL IMAGINATIVE FACULTY [GEOSYS: EIN FRAGE-ANTWORT-SYSTEM MIT RAEUMLICHEM VORSTELLUNGSVERMOEGEN]
Michael Fuernsinn, Mohammed Khenkhar, and Bernd Ruschkowski *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 79-86 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

The relation between propositional versus analogical representation was investigated with respect to the solution of spatial problems in a geographical question-answer system. It explained what spatial problems mean and which concepts were used to solve the problems. The system GEOSYS has a problem solving strategy which uses propositional and (quasi) analogical representation of spatial knowledge whereby relations are obtained by a searching which alternates between both representations. The algorithm which describes the searching principle is presented. ESA

N86-32131# Technische Univ., Berlin (West Germany).
MACHINE LEARNING IN METAXA [MASCHINELLES LERNEN IN METAXA] **c60**
Werner Emde *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 87-115 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

A machine learning model for the acquisition of inferential knowledge on the basis of higher concepts is presented. The emphasis is on problems of incremental knowledge acquisition and hence on the concept of validity domains as a basis for machine learning. A model-controlled procedure, METAXA, characterized by the fact that control models in the knowledge acquisition process are heuristically generated is presented. The declarative representation of inferential knowledge as metaknowledge is shown to be an advantage for all the steps in the knowledge acquisition process. Difficulties occurring in the process of (quasi) cumulative knowledge acquisition are treated. ESA

N86-32132*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE NATURE AND EVALUATION OF COMMERCIAL EXPERT SYSTEM BUILDING TOOLS
William B. Gevarter Jun. 1986 27 p
(NASA-TM-88331; A-86321; NAS 1.15:88331) Avail: NTIS HC A03/MF A01 CSCL 09B

This memorandum reviews the factors that constitute an Expert System Building Tool (ESBT) and evaluates current tools in terms of these factors. Evaluation of these tools is based on their structure and their alternative forms of knowledge representation, inference mechanisms and developer/end-user interfaces. Next, functional capabilities, such as diagnosis and design, are related to alternative forms of mechanization. The characteristics and capabilities of existing commercial tools are then reviewed in terms of these criteria. Author

N86-32133*# Maryland Univ., College Park.
RESEARCH RELATED TO IMPROVED COMPUTER AIDED DESIGN SOFTWARE PACKAGE Semiannual Status Report, 1 Apr. - 1 Oct. 1986
William H. Walston, Jr. 1986 33 p
(Contract NCC5-33)
(NASA-CR-179668; NAS 1.26:179668) Avail: NTIS HC A03/MF A01 CSCL 09B

The comparative computational efficiencies of the finite element (FEM), boundary element (BEM), and hybrid boundary element-finite element (HVFEM) analysis techniques are evaluated for representative bounded domain interior and unbounded domain exterior problems in elastostatics. Computational efficiency is carefully defined in this study as the computer time required to attain a specified level of solution accuracy. The study found the FEM superior to the BEM for the interior problem, while the reverse was true for the exterior problem. The hybrid analysis technique was found to be comparable or superior to both the FEM and BEM for both the interior and exterior problems. Author

N86-32134# Wisconsin Univ., Madison. Mathematics Research Center.
TREE-STRUCTURED CLASSIFICATION VIA GENERALIZED DISCRIMINANT ANALYSIS Technical Summary Report
Wei-Yin Loh and N. Vanichsetakul Jan. 1986 35 p
(Contract DAAG29-80-C-0041; Grants NSF MCS-83-00140; NSF DMS-85-02303)
(AD-A167453; MRC-TSR-2902) Avail: NTIS HC A03/MF A01 CSCL 09/2

Linear techniques are used recursively to construct classification rules which can be represented as k-nary decision trees. The method has been implemented in a computer program called FACT. It can handle ordered and unordered variables, unequal priors, variable misclassification costs, and missing observations. Besides the tree structure, it also yields an importance ranking of the variables and a cross-validation estimate of error. FACT is compared with CART (a procedure proposed recently by Breiman et al., which gives a binary tree) in a series of examples. The conclusion is that FACT and CART are usually comparable in terms of classification accuracy and interpretative capability, but FACT runs many times faster. Author (GRA)

N86-32135# Wisconsin Univ., Madison. Mathematics Research Center.
COMPUTING NARROW INCLUSIONS FOR DEFINITE INTEGRALS Technical Summary Report
George F. Corliss Feb. 1986 31 p
(Contract DAAG29-80-C-0041)
(AD-A167491; MRC-TSR-2913) Avail: NTIS HC A03/MF A01 CSCL 09/2

The ACRITH computer program is used to implement algorithms which give narrow inclusions for definite integrals. Inclusions are obtained from familiar numerical quadrature formulas such as Gaussian or Newton-Cotes with remainder terms, or from the term-by-term integration of Taylor polynomials with remainder terms. Inclusions for the remainder terms are computed using automatic differentiation. The inclusions for the remainder terms are computed using automatic differentiation. The inclusions are valid if the integrand or the endpoints of the interval of integration are real-or interval-valued. Interval inclusions which contain only a few machine numbers are achieved by using ACRITH's accurate scalar product, by using order and subinterval adaptation, and by using special devices such as intersection of several estimates. Numerical examples show that such narrow, guaranteed bounds require about four times as long to compute as the estimates computed by the routine QAGS from QUADPACK. Author (GRA)

N86-32136# Wisconsin Univ., Madison. Mathematics Research Center.
A NEW RESULT IN THE THEORY AND COMPUTATION OF THE LEAST NORM SOLUTION OF A LINEAR PROGRAM Technical Summary Report
Stefano Lucidi Feb. 1986 25 p
(Contract DAAG29-80-C-0041; Grant NSF DCR-84-20963)
(AD-A167515; MRC-TSR-2910) Avail: NTIS HC A02/MF A01 CSCL 09/2

By perturbing properly a linear program to a separable quadratic program it is possible to solve the latter in its dual variable space by iterative techniques such as sparsity-preserving SOR (successive overrelaxation) algorithms. The main result of this paper gives an effective computational criterion to check whether the solutions of the perturbed quadratic programs provide the least 2-norm solution of the original linear program. Author (GRA)

N86-32137# Wisconsin Univ., Madison.
ERROR BOUNDS FOR STRONGLY CONVEX PROGRAMS AND (SUPER)LINEARLY CONVERGENT ITERATIVE SCHEMES FOR THE LEAST 2-NORM SOLUTION OF LINEAR PROGRAMS Summary Report
O. L. Mangasarian and R. DeLeone Mar. 1986 21 p
(Contract DAAG29-80-C-0041; Grants NSF DCR-84-20963; AFOSR-ISSA-85-00080)
(AD-A167536; MRC-TSR-2924) Avail: NTIS HC A02/MF A01 CSCL 12/1

We derive bounds on the distance between an arbitrary point and the unique solution of a strongly convex constrained optimization problem in terms of known violations of the optimality conditions of the problem. These bounds are then used to construct

effective schemes for finding the unique smallest solution of very large sparse linear programs. Given an arbitrary point (x,u) in R superscript n x R sub + superscript m, we give bounds on the Euclidean distance between x and the unique solution x-bar to a strongly convex program in terms of the violations of the Karush Kuhn Tucker conditions by the arbitrary point (x, u). These bounds are then used to derive linearly and superlinearly convergent iterative schemes for obtaining the unique least 2-norm solution of a linear program. These schemes can be used effectively in conjunction with the successive overrelaxation methods for solving very large sparse linear programs. GRA

N86-32138# Naval Postgraduate School, Monterey, Calif.
KALMAN FILTER REAL TIME TRACKING USING MICROPROCESSORS AND A NEW LANGUAGE FOR MILITARY SOFTWARE M.S. Thesis
Jose A. F. Ferreira 27 Mar. 1986 244 p
(AD-A167871) Avail: NTIS HC A11/MF A01 CSCL 09/2

A sequential Extended Kalman filter routine, implemented in the C language, is developed for an embedded computer application. The design takes into account the real time constraints imposed by the sampling time of the data. Filter measurements consist of four (4) transit times generated by torpedo instrumentation in a TEST RANGE facility, and they are nonlinear functions of the coordinates of the torpedo. Memory, speed efficiency, and portability are emphasized in the software design. The program was tested, using simulated trajectories, in an IBM-PC and in a CIE 680/30 microcomputers. Limitations in handling small floating point numbers degraded the performance of the algorithm in the CIE machine which could not track 1/4-G maneuvers. GRA

N86-32139# Naval Postgraduate School, Monterey, Calif.
AIDING COMPUTER APPLICATION PROGRAMMERS AND USERS WITH THE TOOLS OF THE VISUAL INTERFACE M.S. Thesis
Michael N. Fredericksen Mar. 1986 61 p
(AD-A167886) Avail: NTIS HC A04/MF A01 CSCL 09/2

The purpose of this thesis is to explicate the benefits of the computer visual interface by identifying the functional capabilities of some of the visual devices made possible by such an interface, and by examining the ways in which these visual devices can provide tools to aid the programmer in writting, debugging, and unit testing application programs, and the user in learning and using applications. This thesis should give the reader some insight into how current visual technology is being used (or can be used in the furture) to aid the applications programmer and application user. The focus will primarily be on the programmers and users of applications for low-cost desktop computers. Author (GRA)

N86-32140# Royal Signals and Radar Establishment, Malvern (England).
FLEX PASCAL: AN IMPLEMENTATION OF THE ISO-PASCAL PROGRAMMING LANGUAGE
K. Curtis, P. D. Hammond, and P. D. Taylor Dec. 1985 27 p
(AD-A168105; RSRE-MEMO-3908; DRIC-BR-99099) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Flex-Pascal compiler runs on the RSRE Flex computer architecture, which is currently available on the ICL Perq 2 workstation. Flex-Pascal conforms to the ISO 7185 (BS 6192) standard for Pascal and provides (as one extension) a separate-compilation facility. This paper discusses the use of ISO 7185 and the BSI Pascal Validation Suite, and criticises areas of Pascal, which, by their nature, have proved particularly difficult to implement. GRA

N86-32141# Los Alamos National Lab., N. Mex.
TEXT AND GRAPHICS AT LOS ALAMOS: A SYSTEM VIEWPOINT
M. Vigil and S. C. Bouchier 1986 8 p Presented at the ACM Mountain Regional Conference, Santa Fe, N. Mex., 11 Apr. 1986
(Contract W-7405-eng-36)
(DE86-010169; LA-UR-86-1176; CONF-8604177-1) Avail: NTIS HC A02/MF A01

At Los Alamos National Laboratory, a computerized document preparation system is being developed to produce publication-quality documents integrating text and graphics. Mixing text and graphics involves a combination of two different technologies; thus the project has presented numerous and interesting challenges. The requirements, issues, solutions, and continuing concerns of the system development are described. The particular challenges encountered in fitting the document system into the Laboratory's diverse computing network are explained. The paper itself is an example of the type of document the system can produce. DOE

N86-32142# Los Alamos National Lab., N. Mex.
PROGRAMMING A MASSIVELY PARALLEL, COMPUTATION UNIVERSAL SYSTEM: STATIC BEHAVIOR
A. Lapedes and R. Farber 1986 26 p Presented at the Neural Nets and Computation Conference, Snowbird, Utah, 1 Apr. 1986
(Contract W-7405-eng-36)
(DE86-010171; LA-UR-86-1179; CONF-8604173-1) Avail: NTIS HC A03/MF A01

In previous work by the authors, the optimum finding properties of Hopfield neural nets were applied to the nets themselves to create a neural compiler. This was done in such a way that the problem of programming the attractors of one neural net (called the Slave net) was expressed as an optimization problem that was in turn solved by a second neural net (the Master net). In this series of papers that approach is extended to programming nets that contain interneurons (sometimes called hidden neurons), and thus deals with nets capable of universal computation. DOE

N86-32143# Lawrence Livermore National Lab., Calif.
HISTORY OF THE WILSON-FOWLER SPLINE
F. N. Fritsch Apr. 1986 16 p
(Contract W-7405-eng-48)
(DE86-010264; UCID-20746) Avail: NTIS HC A02/MF A01

The Wilson-Fowler spline (WF-spline) was introduced in the early 1960's as a means for drawing a smooth curve through a planar set of data. It has been used as the spline entity in the APT system's TABCYL since its inception. The history of the WF-spline is briefly described and a chronologically arranged annotated bibliography of all known references to it. DOE

N86-32144# Grenoble-1 Univ. (France).
MODELS FOR PROGRAM RELIABILITY: APPLICATION TO A CRITICAL COMPUTER SYSTEM VALIDATION TEST Ph.D. Thesis [LES MODELES DE FIABILITE DU LOGICIEL: APPLICATION AUX ESSAIS DE VALIDATION D'UN SYSTEME INFORMATIQUE CRITIQUE]
Edmond Felix Kouka 1985 262 p In FRENCH
(ESA-86-97283) Avail: NTIS HC A12/MF A01

The rules to stop software design tests in a very high reliability context are investigated. The reference is taken from a railroad microcomputer control system where the reliability requirement is 1 fault for 10 billion hr. Models of computer software reliability are examined including those of Iclinsky and Moranda, Littlewood, and Littlewood and Verral. No sure way is found to make a favorable decision in a time shorter than the reliability requirement. A rule to reject a very high reliability system program is deduced demonstrating the advantage of redesigning rather than continue testing. ESA

N86-32145# Institut National Polytechnique, Grenoble (France). Lab. de Genie Informatique.
MODEL AND FUNCTIONAL DESIGN OF A DATA BASE FOR COMPUTER AIDED DESIGN APPLICATIONS Ph.D. Thesis [MODELE ET FONCTIONNALITES D'UN SGBD POUR LES APPLICATIONS CAO]
Dominique Rieu 1985 246 p In FRENCH
(Contracts AI-84061; CNET-843B061)
(ESA-86-97288) Avail: NTIS HC A11/MF A01

The system described is implemented by modules which are specialized data bases. The data flow is managed by semantic and logical criteria which characterize each of the data bases. The model allows the description of the structures and their

relationship. It also includes the management of the coherence of those relations with the design specifications. A prototype is being made in order to validate the model and to study a cooperative approach between a data base management system and a logic programming system. ESA

N86-32146# Institut National Polytechnique, Grenoble (France).
A RELATIONAL APPROACH TO COMPUTER PROGRAMMING Ph.D. Thesis [UNE PERSPECTIVE RELATIONNELLE DE LA PROGRAMMATION]
Ali Mili 1985 147 p In FRENCH
(ESA-86-97290) Avail: NTIS HC A07/MF A01

Tarski's relational algebra is used to analyze and resolve programming problems such as program specifications, functional analysis of computer programs, program verification and validation, program design and program error treatment. The approach is justified by the fact that the programs are specified with the help of relations, that functional analysis is made by function composition and that program design is made by decomposition of relations. Programming mechanisms are shown by this method that are not easily described otherwise. ESA

N86-32147# Institut National Polytechnique, Grenoble (France).
INTELLIGENT DATA ANALYSIS (INDA) SOFTWARE FOR DATA ANALYSIS Ph.D. Thesis [PROGICIEL INDA POUR L'ANALYSE DES DONNEES: INTELLIGENT DATA ANALYSIS]
Djamel Belaid 1985 88 p In FRENCH Sponsored by Numerical Algorithms Ltd.
(ESA-86-97291) Avail: NTIS HC A05/MF A01

A microcomputer program for the analysis of data by factorial methods is presented. The program is highly interactive and is implemented by separate modules including the assistance to the user to choose one of the proposed methods, the data acquisition module, the execution of the method, results visualization and the overall management. The program is designed for the IBM-PC microcomputer and is written in Pascal language. Up to 100 variables can be processed. The matrix computation uses a Jacobi method. Other algorithms are discussed. A comparison with another program shows an important reduction of the execution time. ESA

N86-32148# Institut National Polytechnique, Grenoble (France).
PAOLA: TOPOLOGICAL OPTIMIZATION SYSTEM FOR PROGRAMMABLE LOGICAL ARRAYS (PLA) Ph.D. Thesis [PAOLA: UN SYSTEME D'OPTIMISATION TOPOLOGIQUE DE PLA]
Tomas PerezSegovia 1985 108 p In FRENCH
(ESA-86-97294) Avail: NTIS HC A06/MF A01

Programmable logic arrays (PLA) are investigated in order to optimize the automatic design of masks for VLSI integrated circuit manufacturing made from the logic description of the circuit. The possible representations of PLA are examined and the methods for topological optimization are presented. The broken lines method is described. The choice of heuristics is discussed as well as the interactions between the optimization stage and the design of the internal connexions. An overall description of the topological optimization PAOLA system is given. It was tested in industrial processes, is written in Pascal language, and is presented in versions adapted to many computers. ESA

N86-32149# Institut National Polytechnique, Grenoble (France).
PROGRAMMING ALGEBRA IN A DATA TYPE VARIANCE Ph.D. Thesis [ALGEBRE DE PROGRAMMES DANS UN UNIVERS TYPE]
Saddek Bensalem 1985 124 p In FRENCH
(ESA-86-97300) Avail: NTIS HC A06/MF A01

A programming algebra based on an abstract data type language is developed. The method features generic operators that can be defined by the user. The result is a large expression power for equivalence rules. The structure of abstract types is contained in generic operators such as homomorphism and inverse homomorphism. The applications of the programming algebra include the test of program without explicit induction, and program transformation methods such as folding-unfolding. ESA

N86-32150# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
RATE DISTORTION CHARACTERISTICS OF TWO ADAPTIVE DATA COMPRESSION ALGORITHMS
W. C. Huisman 15 Mar. 1985 14 p Presented at 4th Symposium on Information Theory in the Benelux, Aalten, Netherlands, 24-25 May 1984
(Contract ESTEC-5047/82-NL-HP)
(NLR-MP-85024-U; B8664740; ESA-86-97671) Avail: NTIS HC A02/MF A01

Two adaptive data compression algorithms easily implemented in a spaceborne micro programmable processor are applied to the compression of simulated image data with Markov properties. The rate distortion characteristics obtained are compared with theoretically attainable bounds. For compression on a block by block basis, the maximum deviation from these bounds is 0.55 to 0.70 bits per pixel respectively. ESA

N86-32151# Nijmegen Univ. (Netherlands). Dept. of Computer Science.
THE COOPERATION TEST: A SYNTAX-DIRECTED VERIFICATION METHOD
Willem P. deRoever, Jr. Feb. 1985 47 p
(Rept-62; ESA-86-97714) Avail: NTIS HC A03/MF A01

The cooperation test, conceived to capture the proof theoretical analog of a distributed message passing between disjoint processes, as opposed to the interference test, the proof theoretical analog of concurrency based on interference by jointly shared variables, is reviewed. The cooperation test was applied to characterize concurrent communication in Hoare's communicating sequential processes, Ichbiah's ADA, and Brinch Hansen's distributed processes, supported by soundness and completeness proofs. The rationale underlying this characterization, culminating in the development of proof systems for monitor based programming languages for concurrency which combine distributed message passing between processes with interference through local variables of a process which are shared between its subprocesses, is given. ESA

N86-32152# Nijmegen Univ. (Netherlands). Dept. of Informatics.
AVOIDING REDEX COPYING IN LAMBDA REDUCTION
M. C. J. D. vanEekelen and M. J. Plasmeijer Mar. 1985 16 p
(Rept-63; ESA-86-97715) Avail: NTIS HC A02/MF A01

A graph reduction strategy for lambda calculus which avoids copying of redexes and hence reduces the number of reduction steps is given. This strategy appears to be optimal. An algorithm for this strategy is outlined. ESA

N86-32153# Nijmegen Univ. (Netherlands), Dept. of Informatics.
INTERACTIVE PROGRAMS IN A FUNCTIONAL LANGUAGE. A FUNCTIONAL IMPLEMENTATION OF AN EDITOR
Pieter Koopmann 1985 12 p
(Rept-65; ESA-86-97716) Avail: NTIS HC A02/MF A01

Ease of programming in a functional language was assessed by writing a UNIX-like text editor in SASL. The result is very satisfactory. Once used to the functional style, programming is quite easy. The program itself is significantly more elegant than a program written in an imperative style, while being 10 times as compact. ESA

N86-32154# Nijmegen Univ. (Netherlands). Dept. of Informatics.
TRACING AND DEBUGGING IN SASL
Th. G. A. vanderLee and H. Oolman Apr. 1985 11 p
(Rept-66; ESA-86-97717) Avail: NTIS HC A02/MF A01

A tracer and a debugger for the SASL programming language are presented. The tracing of the functions makes it possible to check the progress of an evaluation. The evaluation order requires adaptation on the part of the programmer. Programmers are so used to applicative order evaluation that the trace of lazy evaluation in normal order combined with call by need appears unexpected

at first. However this adaptation requires little time. The breakpoint mechanism allows inspection of arguments of a function or, if the result is a list, the elements of that list. ESA

N86-32155# Nijmegen Univ. (Netherlands). Dept. of Informatics.
PRODUCTION OF CODICOLOGICAL CATALOGS USING COMPUTERS (PCC PROJECT) [PRODUCTIE VAN CODICOLOGISCHE CATALOGI MET BEHULP VAN COMPUTERS (PPC-PROJECT)]
P. F. Beinema, A. J. Geurts, A. Gruijs, C. H. A. Koster, and J. vanKrieken Apr. 1985 76 p In DUTCH
(Rept-67; ESA-86-97718) Avail: NTIS HC A05/MF A01

The possibilities of fast and efficient production of handwriting catalogs using computers were investigated. The description scheme for codices and the description activities are presented. The programming package developed for codicological application is described. An evaluation of the project shows negative results: the programming interface technique, the poor flexibility of PCC-scheme and programming, the required time, the printing facilities, and the poor after-care. Positive results are: codicological innovation, interface diagrams, portability of the programming language to other machines, and two flexible programs. ESA

N86-32156# Nijmegen Univ. (Netherlands). Dept. of Informatics.
SYSTEM SEMANTICS AND FORMAL CIRCUIT DESCRIPTION
Raymond T. Boute Aug. 1985 39 p Supersedes Rept-56
(Rept-69; ESA-86-97719) Avail: NTIS HC A03/MF A01

The concept of system semantics, an extension of the denotational theory of programming languages to the description of arbitrary systems is introduced. Application to analog circuits is described. Instead of reasoning on the basis of schematic diagrams, one directly manipulates the circuit descriptions themselves as formulas for various purposes such as correctness proving and the derivation of properties. Properties may range from general theorems of circuit theory, expressed as conversion rules in the language, to special conditions for particular circuits, expressed as equations in the metalanguage. The fact that a single functional language can be used as the metalanguage and at the same time provide the syntax for system description indicates a coherent way for practical implementation. ESA

N86-32157# Groningen Rijksuniversiteit (Netherlands). Computing Science Section.
ALGORITHMS FOR ON-THE-FLY GARBAGE COLLECTION REVISTED
Jan L. A. vandeSnepscheut 1985 11 p
(CS-8507; ESA-86-97741) Avail: NTIS HC A02/MF A01

A proof of Dijkstra et al's (1978) on-the-fly garbage collection algorithm is presented. It is argued that the reasoning about invariants, especially the distinction between P0 and P1, more clearly captures the quintessence, and more clearly exposes the beauty of the algorithm, than the original presentation. ESA

N86-32158# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
THE ALGEBRA OF COMMUNICATING PROCESSES WITH EMPTY PROCESS
J. L. M. Vrancken Jan. 1986 60 p Submitted for publication Sponsored by European Economic Commission
(FVI-86-01; B8664355; ESA-86-97745) Avail: NTIS HC A04/MF A01

Axiom systems which are the systems BPA, PA, and ACP extended with the empty process are presented. For the system ACP extension, which contains the other three systems, the most basic supplementary axioms are given, and adapted such that they can deal with the empty process, and a graph model is constructed. The validity of the supplementary axioms is proved in the closed term model and the graph model. ESA

N86-32159# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
TRANSITION SYSTEMS, METRIC SPACES AND READY SETS IN THE SEMANTICS OF UNIFORM CONCURRENCY
J. W. deBakker, J.-J. Ch. Meyer (Vrije Universiteit, Amsterdam (Netherlands).), E.-R. Olderog (Kiel Univ. (West Germany).), and J. I. Zucker (State Univ. of New York, Buffalo.) Jan. 1986 109 p Submitted for publication Sponsored in part by European Economic Commission
(Grant NSF MCS-80-10728)
(CWI-CS-R8601; B8664600; ESA-86-97751) Avail: NTIS HC A06/MF A01

Transition systems as proposed by Hennessy and Platkin (1979) are defined for three languages featuring concurrency. The first has shuffle and local nondeterminacy, the second synchronization merge and local nondeterminacy, and the third synchronization merge and global nondeterminacy. The languages are all uniform in the sense that the elementary actions are uninterpreted. Infinte behavior is taken into account and modeled with infinitary languages in the sense of Nivat. A comparison with denotational semantics is provided. For the first two languages, a linear time model suffices; for the third language a branching time model with processes in the sense of De Bakker and Zucker is described. In the comparison an important role is played by an intermediate semantics in the style of Hoare and Olderog's specification oriented semantics. A variant on the notion of ready set is employed here. Precise statements relating the various semantics in terms of abstraction operators are given. ESA

N86-32160# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
PATTERN REPRESENTATION
P. J. W. tenHagen and C. G. Trienekens Jan. 1986 28 p Sponsored by Netherlands Technology Foundation
(CWI-CS-R8602; B8664601; ESA-86-97752) Avail: NTIS HC A03/MF A01

A method of representing area oriented picture primitives is introduced. The representation aims at efficient conversion of these primitives to frame buffers for raster displays. The representation and the conversion to raster can be the basis for area generators comparable in speed to vector generators used in conventional vector displays. The representation is independent of the type and resolution of raster hardware. As a result interactive graphics on raster display can be of higher quality because of fast responses involving picture change without compromising picture quality. ESA

N86-32161# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
CONTRASTING THEMES IN THE SEMANTICS OF IMPERATIVE CONCURRENCY
J. W. deBakker, J. N. Kok, J.-J. Ch Meyer, E.-R. Olderog, and J. I. Zucker Jan. 1986 61 p Submitted for publication Sponsored in part by European Economic Commission
(Grants ZWO-125-20-04; NSF MCS-80-10728)
(CWI-CS-R8603; B8664602; ESA-86-97753) Avail: NTIS HC A04/MF A01

Four sample languages for which operational and denotational semantic models are developed are presented. All languages have parallel execution through interleaving, and three have a form of synchronization. Three languages are uniform, i.e., they have uninterpreted elementary actions; the fourth is nonuniform and has assignment, tests and value-passing communication. The operational models build on Hennessy-Plotkin transition systems; as denotational structures both metric spaces and cpo domains are employed. Two forms of nondeterminacy are distinguished, the local and global variety. Linear time versus branching time is investigated. In the former, streams, i.e., finite or infinite sequences of actions; in the latter the (metrically based) notion of process is introduced. Ready sets are used to compare semantics. ESA

N86-32162# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
EXTENDED GENERAL DESIGN THEORY
Tetsuo Tomiyama and Hiroyuki Yoshikawa (Tokyo Univ. (Japan).) Jan. 1986 32 p Presented at IFIP Working Group 5.2 Working

Conference on Design Theory for CAD, Tokyo, Japan, 1-3 Oct. 1985 Revised Submitted for publication
(CWI-CS-R8604; B8664603; ESA-86-97754) Avail: NTIS HC A03/MF A01

A hypothesis concerning the physical aspects of designing is introduced to general design theory, and from it theorems useful for computer aided design (CAD) are deduced. In the real knowledge, the design solution is obtained as a cluster point. In the real knowledge, the concept of metamodel which is defined by a set of a finite number of attributes is useful, and it leads to a design process model called evolution model. This design process model can give a reasonable explanation on real design processes. It is possible to give metric to the attribute space in the real knowledge. From general design theory, it is deduced that an extensional description method is more suitable for CAD systems than an intensional one, theoretically, but practically both of them should be combined. ESA

N86-32163# Centre National d'Etudes Spatiales, Toulouse (France).
QUALITY CONTROL OF FILED SUBROUTINES. LEAST SQUARES METHOD. DEVELOPMENT AND VALIDATION OF SOME ALGORITHMS
J. C. Berges, C. Philips, and B. Henninger 6 Jun. 1984 110 p In FRENCH; ENGLISH summary
(CNES-CT/DTI/MS/MN/132; ESA-86-97645) Avail: NTIS HC A06/MF A01

The parameter estimation of nonlinear functions is studied to optimize a differential correction procedure based on maximum likelihood estimates. The work is a contribution to improve the quality of a mathematical software library for satellite programs and Solar computers. The Bulirsch and Stoer method and the Levenberg-Marquardt steepest descent algorithm were adapted to Solar computers. The theoretical analysis shows that the residual sum function must be convex in relation to the investigated parameter. ESA

N86-32164# Centre National d'Etudes Spatiales, Toulouse (France).
LANCELOT: LONG TERM DISTANCE COMPUTATION AND ANALYSIS SOFTWARE
SaintPe Jun. 1984 113 p In FRENCH; ENGLISH summary
(CNES-CT/DI/MS/MS/080; ESA-86-97647) Avail: NTIS HC A06/MF A01

A computer program to compute the distances of different payloads in Ariane multiple launch during the first orbits is presented. The program input is given by mission data and user instructions. The results, available in file or in listings, can be used for supplementary data processing. The memory employed is 120,000 bytes. The simulations give computation times varying from 28 to 44 sec. ESA

N86-32165# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
REDUCE: A COMPUTER ALGEBRA SYSTEM
J. C. Agnese 24 Sep. 1984 37 p In FRENCH; ENGLISH summary
Presented at a Colloquium on Applied Algebra, Algorithmic, Error Correcting Codes
(CNES-CT/DTI/MS/MN/201; ESA-86-97653) Avail: NTIS HC A03/MF A01

The REDUCE algebra is reviewed. The system may be implemented with many computers such as PDP 10 (60,000 bytes) or IBM 360/370 (30,000 bytes memory utilization). The language is based on Lisp. ESA

N86-32166# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
MUMATH COMPUTER ALGEBRA SYSTEM FOR MICROCOMPUTERS
J. C. Agnese 14 Oct. 1985 58 p Partly in ENGLISH and FRENCH
(CNES-CT/DTI/MS/MN/311; ESA-86-97655) Avail: NTIS HC A04/MF A01

The characteristics of the MUMATH-83 program are reviewed. It is designed for IBM/PC compatible microcomputers. Examples of applications are given. The details of the utilization are explained. ESA

N86-32167# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Mathematiques Spatiales.
THE MSTN SOFTWARE. TRIGONOMETRIC SERIES MANIPULATOR
J.-C. Agnese 13 Nov. 1984 60 p In FRENCH; ENGLISH summary
(CNES-CT/DTI/MS/MN/262; ESA-86-97656) Avail: NTIS HC A04/MF A01

A computer program for symbolic manipulation of trigonometric series, often used in space mechanics, is presented. A thematic classification of 14 modules is given. A user's manual and a theoretical description are included for each module. ESA

N86-32168# Kernforschungszentrum, Karlsruhe (West Germany).
ESPRIT PROJECT 322: COMPUTER AIDED DESIGN (CAD) DESIGN INTERFACES Status Report
I. Bey, ed. and J. Leuridan, ed. Mar. 1986 183 p
(KfK-PFT-121; ESA-86-98741; SR-2) Avail: NTIS HC A09/MF A01

The most important interfaces in CAD/CAM systems for data exchange, data base, finite element analysis, experimental analysis, and advanced modeling were defined. The definitions of these interfaces are being elaborated in harmony with international standardization efforts. Wire frames, solids, free form surfaces, and geometric aspects were examined. ESA

N86-32169# Fondazione Ugo Bordoni, Rome (Italy).
A QUANTITATIVE APPROACH TO COMPUTER SYSTEMS ENGINEERING [UN APPROCCIO QUANTITATIVO ALL'INGEGNERIA DEI SISTEMI INFORMATICI]
Giuseppe Iazeolla Jan. 1985 29 p In ITALIAN
(FUB-5-1985; ESA-86-97883) Avail: NTIS HC A03/MF A01

The importance of quantification to derive clear computer specifications and design parameters is emphasized. The need to proceed by developing and solving mathematical models is asserted, showing the limitations of an artificial intelligence approach. The goals are discussed in terms of performance, reliability and availability. Data transmission networks are taken as examples of the design development progress. It is concluded that simulation and mathematical techniques are the best way to develop quantitative methods for the analysis and synthesis of computer systems. ESA

N86-31959# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A SOFTWARE CONCEPT FOR INTERACTIVE LETTER LOCATION THROUGH DIGITAL IMAGE PROCESSING [EIN SOFTWAREKONZEPT ZUR INTERAKTIVEN SCHRIFTPLAZIERUNG MITTELS DIGITALER BILDVERARBEITUNG]
Ulrich Theissing *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 155-162 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N86-32170# Lawrence Livermore National Lab., Calif.
PHYSICS CODES ON PARALLEL COMPUTERS
P. G. Eltgroth Dec. 1985 10 p Presented at the Parallel Computing Conference, West Berlin, West Germany, 23 Sep. 1985
(Contract W-7405-eng-48)
(DE86-006712; UCRL-93712; CONF-8509200-3) Avail: NTIS HC A02/MF A01

An effort is under way to develop physics codes which realize the potential of parallel machines. A new explicit algorithm for the

computation of hydrodynamics has been developed which avoids global synchronization entirely. The approach, called the Independent Time Step Method (ITSM), allows each zone to advance at its own pace, determined by local information. The method, coded in FORTRAN, has demonstrated parallelism of greater than 20 on the Denelcor HEP machine. ITSM can also be used to replace current implicit treatments of problems involving diffusion and heat conduction. Four different approaches toward work distribution have been investigated and implemented for the one-dimensional code on the Denelcor HEP. They are self-scheduled, an ASKFOR monitor, a queue of queues monitor, and a distributed ASKFOR monitor. The self-scheduled approach shows the lowest overhead but the poorest speedup. The distributed ASKFOR monitor shows the best speedup and the lowest execution times on the tested problems. DOE

N86-32171# Argonne National Lab., Ill.
PERFORMANCE MODELLING OF LARGE-GRAINED PARALLELISM
R. L. Crane, M. Minkoff, K. E. Hillstrom, and S. D. King Mar. 1986 32 p
(Contract W-31-109-eng-38)
(DE86-009664; ANL/MCS-TM-63) Avail: NTIS HC A03/MF A01

Mathematical modelling, computer simulation, and graphical methods are used to analyze the performance of parallel computers. Speedup is used as a performance measure. Large-grained parallel computation is considered, i.e., the case in which multiple tasks each involving substantial computation are executed concurrently. A variable-length task involving the solution of a set of ordinary differential equations is defined and used to validate the performance models that are developed. Experimental results are shown for two machines, a Denelcor HEP with a single process execution module, and an Alliant FX/8. DOE

N86-32172# Sandia National Labs., Albuquerque, N. Mex.
PRACTICAL PARADIGM FOR PARALLEL PROCESSING PROBLEMS
G. S. Davidson Mar. 1986 16 p
(Contract DE-AC04-76DP-00789)
(DE86-009274; SAND-85-2389) Avail: NTIS HC A02/MF A01

Data flow computers achieve high performance by keeping as many processing elements busy as possible for a given algorithm. However, without specialized architectures, the synchronization overhead of data-driven computations can prevent significant speedup. To address this problem, the concept of task flow is developed for more general purpose multiprocessors. Task flow differs from data flow in the amount of computation between synchronizations (at the expense of some parallelism). A software technique is described that implements task flow for general purpose multiprocessors with local and shared memories. A SANDAC-iV multiprocessor example of this technique is given, together with timing results. DOE

N86-32173# Oak Ridge National Lab., Tenn.
SPARSE CHOLESKY FACTORIZATION ON A LOCAL-MEMORY MULTIPROCESSOR
A. George, M. T. Heath, J. Liu, and E. Ng Apr. 1986 22 p
(Contract DE-AC05-84OR-21400)
(DE86-010082; ORNL/TM-9962) Avail: NTIS HC A02/MF A01

The problem of factoring a large sparse positive definite matrix is implemented on a multiprocessor system. The processors are assumed to have substantial local memory but no globally shared memory. They communicate among themselves and with a host processor through message passing. The primary interest is in designing an algorithm which exploits parallelism, rather than in exploiting features of the underlying topology of the hardware. However, part of the study is aimed at determining, for certain sparse matrix problems, whether hardware based on the binary hypercube topology adequately supports the communication requirements for such problems. Numerical results from experiments running on a multiprocessor simulator are included. DOE

N86-32174# Los Alamos National Lab., N. Mex.
HYPERCUBE PROJECT AND A SIMULATOR FOR A HYPERCUBE OF COMPUTERS
J. P. Hong, R. D. Tomlinson, N. Patel, and L. H. Pollard 1985 9 p Presented at the Conference on Hypercube Microprocessors, Knoxville, Tenn., 1 Aug. 1985
(Contract W-7405-eng-36)
(DE86-010164; LA-UR-86-1151; CONF-8508173-1) Avail: NTIS HC A02/MF A01

The Los Alamos National Laboratory and the University of New Mexico are working on HC, a hypercube project for large problems. A hypercube of 1024 nodes is being designed; implementation of a machine of at least 16 nodes is underway. The nodes of the machine are complete computer systems, including mass storage and a large main memory. The computational abilities of each node are enhanced by using a detached instruction fetch-execute-store organization. This allows the execution rate to achieve a consistently high level, approaching 90% of optimum. Trade-offs in the implementation methods indicate the speeds available with acceptable hardware investments. A simulator has been written which allows execution of high level programs on a hypercube organization. The simulator has shown that programs prepared for execution on a single stream machine can be easily modified to use the resources of a parallel machine, and that the results are identical to previous executions. DOE

N86-32175# Technische Hogeschool Twente, Enschede (Netherlands). Interface, Protocol en Service Systemen Vakgroep.
DESIGN AND IMPLEMENTATION OF A DRIVER AND INITIALIZATION PROGRAM FOR THE LOCAL AREA NETWORK (LAN) TWENTENET Ph.D. Thesis [ONTWERP EN IMPLEMENTATIE VAN EEN DRIVER EN EEN INITIALISATIE PROGRAMMA VOOR HET TWENTENET]
A. vanLeussen Mar. 1984 156 p In DUTCH; ENGLISH summary
(INF83/IPS/044; ESA-86-97370) Avail: NTIS HC A08/MF A01

A driver and initialization program for the Channel, the second layer of TWENTENET, were designed, constituting the data-link layer of the OSI-ISO reference model. Bus and ring topologies, as well as different access mechanisms were provided. The initialization consists of a self-test and the loading of system relevant parameters like the own address. By transmitting messages to itself the Channel is tested for a number of errors. In principle it is possible to obtain the system parameters from another (supervisor) station. A provisional implementation of the Channel driver and initialization program was realized in language C for UNIX V7 running on a PDP 11/45 machine. ESA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N86-32176# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DISCOVERY SYSTEMS
Kenneth W. Haase, Jr. Apr. 1986 20 p
(Contracts N00014-80 C 0505; N00014-79-C-0260)
(AD-A167852; AI-M-898) Avail: NTIS HC A02/MF A01 CSCL 09/2

Cyrano is a thoughtful reimplementation of Lenat's controversial Eurisko computer program, designed to perform automated discovery and concept formation in a variety of technical fields. The thought in the reimplementation has come from several directions: and appeal to basic principles, which led to identifying constraints of modularity and consistency on the design of discovery systems; an appeal to transparency, which led to collapsing more and more of the control structure into the representation; and an appeal to accountability, which led to the explicit specification of dependencies in the concept formation

process. The process of reimplementing Lenat's work has already revealed several insights in the nature of Eurisko-like systems in general these insights are incorporated into the design of Cyrano. Foremost among these new insights is the characterization of Eurisko-like systems (which I call inquisitive systems) as search processes which dynamically reconfigure their search space by the formation of new concepts and representations. This insight reveals requirements for modularity and consistency in the definition of new concepts and representations. Author (GRA)

N86-32177# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
PERFORMANCE ANALYSIS OF A MICROCOMPUTER-BASED SINGLE-LOOP DIGITAL CONTROL SYSTEM Final Technical Report, Aug. 1982 - Aug. 1984
Michael J. Gauder Apr. 1986 81 p
(AD-A167914; AFWAL-TR-85-2074) Avail: NTIS HC A05/MF A01 CSCL 09/5

Digital control system design has been popular in the aerospace and process control industries. Advances in microprocessor technologies have added new growth to this popularity. The use of microprocessor-based systems for control purpose places demands on digital control theory. Since microprocessors are relatively slow digital machines and usually have small work lengths, it is necessary to place importance on the effects of time delays and amplitude quantization with respect to the control system. The wind length and speed of the signal processing components; Analog-to-Digital (A/D) and Digital-to-Analog (D/A) converters placed additional constraints on the digital control system performance. In order to be able to analyze the effects of constraints that are involved in microprocessor-based control system design, it will be necessary to develop a basic system and a set of procedures that are modifiable to a variety of control configurations. The subject of this thesis is the design, development, and analysis of a 16-bit microprocessor based digital control system. The purpose of the study is threefold: (1) To show that a hybrid computer system, consisting of 16-bit single board microcomputer and an analog computer, can be used effectively for digital control studies; (2) To evaluate the frequency response of the hybrid system; and (3) To identify and evaluate the error contributors which can effect the performance of digital control systems. GRA

N86-32178# Sandia National Labs., Albuquerque, N. Mex.
REMOTE MAINTENANCE ROBOT SYSTEM FOR A PULSED NUCLEAR REACTOR
S. Thunborg Sep. 1985 23 p Presented at the IEEE International Conference on Robotics and Automation, San Francisco, Calif., 14 Apr. 1986
(Contract DE-AC04-76DP-00789)
(DE86-000206; SAND-85-2103C; CONF-860434-4) Avail: NTIS HC A02/MF A01

This paper presents a remote maintenance robot system for use in a hazardous environment. The system consists of turntable, robot and hoist subsystems which operate under the control of a supervisory computer to perform coordinated programmed maintenance operations on a pulsed nuclear reactor. The system is operational and the oral presentation will include a videotape of the system in operation. DOE

N86-32179# Oak Ridge National Lab., Tenn.
STATE AND DATA TECHNIQUES FOR CONTROL OF DISCONTINUOUS SYSTEMS
R. A. Kisner 1986 21 p Presented at the 6th Power Plant Dynamics, Control and Testing Symposium, Knoxville, Tenn., 14 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-007240; CONF-860414-2) Avail: NTIS HC A02/MF A01

This paper describes a technique for structured analysis and design of automated control systems. The technique integrates control of continuous and discontinuous nuclear power plant subsystems and components. A hierarchical control system with distributed intelligence follows from applying the technique. Further, it can be applied to all phases of control system design. For simplicity, the example used in the paper is limited to phase 1 design (basic automatic control action), in which no maintenance, testing, or contingency capability is attempted. DOE

N86-32180# Brookhaven National Lab., Upton, N. Y.
COMPARISON OF THE DOMAIN AND FREQUENCY DOMAIN STATE FEEDBACKS
S. Y. Zhang 1986 3 p Presented at the American Control Conference, Seattle, Wash., 18 Jun. 1986
(Contract DE-AC02-76CH-00016)
(DE86-009429; BNL-37844; CONF-860638-2) Avail: NTIS HC A02/MF A01

In this paper, we present explicitly the equivalence of the time domain and frequency domain state feedbacks, as well as the dynamic state feedback and a modified frequency domain state feedback, from the closed-loop transfer function point of view. The difference of the two approaches is also shown. DOE

N86-32181# Brookhaven National Lab., Upton, N. Y.
ZERO MODELS AND POLE MODELS FOR MULTIVARIABLE SYSTEMS
S. Y. Zhang 1986 5 p Presented at the American Control Conference, Seattle, Wash., 18 Jun. 1986
(Contract DE-AC02-76CH-00016)
(DE86-009442; BNL-37846; CONF-860638-3) Avail: NTIS HC A02/MF A01

In this paper, the concepts of zero models and pole models are introduced for the multivariable systems. The definitions are different from the existing definitions of poles and zeros for multivariable systems they reflect more structural informations for the systems, and can be used to study the external properties of the systems. The pole models and zero models in the closed-loops are also discussed. It will be shown that the zero models of the closed loop systems play a key role in the tracking and rejection problem. DOE

N86-32182# International Centre for Theoretical Physics, Trieste (Italy).
OPTIMAL CONTROL FOR PARABOLIC-HYPERBOLIC SYSTEM WITH TIME DELAY
A. Kowalewski Jul. 1985 16 p
(DE86-701709; IC-85/70) Avail: NTIS (US Sales Only) HC A02/MF A01

In this paper we consider an optimal control problem for a system described by a linear partial differential equation of the parabolic-hyperbolic type with time delay in the state. The right-hand side of this equation and the initial conditions are not continuous functions usually, but they are measurable functions belonging to L(2) or Lsup(infinity) spaces. Therefore, the solution of this equation is given by a certain Sobolev space. The time delay in the state is constant, but it can also be a function of time. The control time T is fixed in our problem. Making use of the Milutin-Dubovicki theorem, necessary and sufficient conditions of optimality with the quadratic performance functional and constrained control are derived for the Dirichlet problem. The flow chart of the algorithm which can be used in the numerical solving of certain optimization problems for distributed systems is also presented. DOE

N86-32183# Lanchester Polytechnic, Coventry (England). Dept. of Systems and Control.
SELF-TUNING CONTROL PRINCIPLES APPLIED TO BILINEAR SYSTEMS
K. J. Burnham, D. J. G. James, and D. N. Shields 1985 15 p
(IR-SC-85-2; ESA-86-97261) Avail: NTIS HC A02/MF A01

A quasi-linear self-tuning control algorithm for a class of single input single output bilinear systems is derived. It involves an extended statespace pole-assignment approach which is applied to a linearized model of the bilinear system, updated at each sample point. The extended approach uses an adaptive steady state Kalman filter for state estimation, and an adaptive least squares scheme, employing a variable forgetting factor, for parameter estimation. ESA

N86-32184# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE SIMPLE PLANT LOCATION PROBLEM. A PLEA FOR BALINSKI'S CONJECTURE M.S. Thesis
C. A. J. Hurkens Apr. 1984 34 p
(ESA-86-97304) Avail: NTIS HC A03/MF A01

The simple plant location (SPL) problem (uncapacitated facility location problem) is studied. The fact that SPL can be considered as a special case of the set partitioning problem is presented. The fact that the linear programming solutions of SPL can be integer solutions (Balinski's conjecture) is discussed. Experiment results are given. ESA

N86-32185# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
MULTISENSOR SYSTEMS SEEN FROM DIFFERENT POINTS OF VIEW
Ed Kuijpers Jan. 1986 21 p
(FVI-86-02; B8664356; ESA-86-97746) Avail: NTIS HC A02/MF A01

Examples of problems and solutions for multisensor systems are given to show different aspects of these systems which need further theoretical and experimental research. The examples are grouped in modeling for sensors, reasoning with sensors, classification and sensors, interaction between sensors, learning and testing for sensors, and architectures for sensors. ESA

N86-32125# Technische Univ., Berlin (West Germany).
THE SIMULATION OF NATURAL KNOWLEDGE SYSTEMS [ZUR SIMULATION NATUERLICHER WISSENSSYSTEME]
Claus-Rainer Rollinger *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 13-21 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

N86-32126# Technische Univ., Berlin (West Germany).
TEXT UNDERSTANDING: INTERESTINGNESS AS A BASIS FOR THE VARIATION OF THE ANALYSIS DEPTH [TEXTVERSTEHEN: INTERESSENSGESTEUERTE VARIATION DER ANALYSETIEFE]
Claus-Rainer Rollinger and Hans-Jochen Schneider *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 23-30 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

N86-32128# Technische Univ., Berlin (West Germany).
THE REPRESENTATION OF KNOWLEDGE FOR SITUATIONS AND EVENTS IN A DYNAMIC WORLD [WISSENSREPRAESENTATION FUER ZUSTAENDE UND EREIGNISSE IN EINER DYNAMISCHEN WELT]
Albrecht Schmiedel and Kai vonLuck *In its* Text Understanding: Interestingness as a Basis for the Variation of the Analysis Depth Dec. 1985 p 53-65 In GERMAN (For primary document see N86-32124 23-61)
Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-32186 Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
TWO ALGORITHMS FOR THE CONSTRUCTION OF GREATEST RIGHT DIVISORS OF A POLYNOMIAL MATRIX M.S. Thesis
G. Zwaan May 1984 97 p
(ESA-86-97302) Avail: Issuing Activity

A linear system of ordinary differential equations over a frequency domain is considered. Two algorithms (Silverman-Van Dooren algorithm and Emre algorithm) for the construction of greatest right divisor (GRD) of polynomial matrix to the system taking the Laplace transformation are studied. Numerical results for the construction of right matrix-fraction description (MFD) and left MFD for the transfer function matrix (rational matrix), are given. ESA

N86-32187 Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Methodische Grundlagen.
EFFICIENT HIGH ORDER ALGORITHMS FOR ELLIPTIC BOUNDARY VALUE PROBLEMS USING FULL MULTIGRID TECHNIQUES TOGETHER WITH EXTRAPOLATION METHODS
Anton Schueller and Qun Lin Dec. 1985 17 p
(GMD-192; ISSN-0723-0508; ESA-86-97475) Copyright. Avail: Issuing Activity

Three efficient algorithms for accelerating the convergence of linear elliptic second order differential operator in boundary value problems using multigrid techniques (nested iteration), are presented. The extrapolation techniques are applied to finite difference methods. The Ricard extrapolation, splitting extrapolation and local discretization error extrapolation are compared. Numerical tests for two examples are given. ESA

N86-32188*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LEAST SQUARES FINITE ELEMENT SIMULATION OF TRANSONIC FLOWS Final Report
T. F. Chen and G. J. Fix May 1986 29 p Submitted for publication
(Contract NAS1-17070)
(NASA-CR-178121; NAS 1.26:178121; ICASE-86-27) Avail: NTIS HC A03/MF A01 CSCL 12A

Finite difference approximation of transonic flow problems is a well-developed and largely successful approach. Nevertheless, there is still a real need to develop finite element methods for applications arising from fluid-structure interactions and problems with complicated boundaries. In this paper a least squares based finite element scheme is introduced. It is shown that, if suitably formulated, such an approach can lead to physically meaningful results. Bottlenecks that arise from such schemes are also discussed. Author

N86-32189*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STABILITY ANALYSIS OF INTERMEDIATE BOUNDARY CONDITIONS IN APPROXIMATE FACTORIZATION SCHEMES Final Report
Jerry C. South, Jr., Mohammed M. Hafez (California Univ., Davis.), and David Gottlieb (Brown Univ., Providence, R. I.) May 1986 28 p Submitted for publication
(Contracts NAS1-17070; NAS1-18107; Grant AF-AFOSR-0303-85)
(NASA-CR-178126; ICASE-86-36; NAS 1.26:178126) Avail: NTIS HC A03/MF A01 CSCL 12A

The paper discusses the role of the intermediate boundary condition in the AF2 scheme used by Holst for simulation of the transonic full potential equation. It is shown that the treatment suggested by Holst led to a restriction on the time step and ways to overcome this restriction are suggested. The discussion is based on the theory developed by Gustafsson, Kreiss, and Sundstrom and also on the von Neumann method. Author

N86-32190# Wisconsin Univ., Madison.
THE EVALUATION OF INNER PRODUCTS OF MULTIVARIATE SIMPLEX SPLINES Technical Summary Report
Thomas A. Grandine Feb. 1986 14 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-82-10950)
(AD-A167485; MRC-TSR-2909) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper gives a general method for the stable evaluation of inner products of multivariate simplex splines. The method is based on a recurrence relation for these inner products. The

base cases for this recurrence relation are handled by triangulating certain simploids into simplices. Author (GRA)

N86-32191# Wisconsin Univ., Madison.
ORBITAL COMPACTNESS AND ASYMPTOTIC BEHAVIOR OF NON-LINEAR PARABOLIC SYSTEMS WITH FUNCTIONALS Technical Summary Report
Reinhard Redlinger Jan. 1986 29 p
(Contract DAAG29-80-C-0041)
(AD-A167486; MRC-TSR-2897) Avail: NTIS HC A03/MF A01 CSCL 12/1

In recent years, reaction-diffusion systems have become widely used as models in biology, chemistry and population dynamics. A major point of interest is the long-time behavior of the solutions. For systems governed by ordinary differential equations the asymptotic behavior is usually investigated using Liapunov functionals in conjunction with an invariance principle. The purpose of this paper is to extend these methods to a general class of distributed systems that admit possible hysteresis effects in the reaction mechanism. GRA

N86-32192# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE THEOREM OF WEINSTEIN Summary Report
Paul H. Rabinowitz Feb. 1986 18 p
(Contract DAAG29-80-C-0041; Grant NSF MCS81-10556)
(AD-A167492; MRC-TSR-2912) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper contains an existence theorem for a special class of periodic solutions of Hamiltonian systems and generalizes an earlier result of the same nature due to Weinstein. He studied a general class of mechanical systems and established the existence of special kinds of periodic solutions which he called brake orbits. Roughly speaking these solutions start at the boundary of a potential well with 0 velocity and return to the edge of the well, again with 0 velocity, a half period later. This paper contains a generalization of his results using minimax methods form the calculus of variations as the existence tool. GRA

N86-32193# Wisconsin Univ., Madison.
OPTIMAL IMPLEMENTATION OF DIFFERENTIATION ARITHMETIC Summary Report
L. B. Rall Mar. 1986 18 p
(Contract DAAG29-80-C-0041)
(AD-A167494; MRC-TSR-2920) Avail: NTIS HC A02/MF A01 CSCL 12/1

Differentiation arithmetic is an ordered-pair arithmetic which evaluates both the value and derivative of functions defined by formulas or subroutines, without symbolics or approximations. As in the case of complex arithmetic, multiplication and division are defined in terms of several real operations. Algorithms are given for evaluation of these operations with the same accuracy as real multiplication and division, that is, to the closest floating-point number. The same kind of optimal implementation is described for Taylor arithmetic, which permits calculation of Taylor coefficients of arbitrary order for functions defined by formulas or subroutines. Author (GRA)

N86-32194# Wisconsin Univ., Madison.
FINITE DIFFERENCE METHODS FOR POLAR COORDINATE SYSTEMS Technical Summary Report
John C. Strikwerda and Yvonne Nagel Apr. 1986 21 p
(Contracts DAAG29-80-C-0041; N00014-84-K-0454)
(AD-A167512; MRC-TSR-2934) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document discusses finite difference methods for partial differential equations on polar and spherical coordinate systems. The distinctive feature of these coordinate systems is the coordinate system singularity at the origin. The authors show how to accurately and conveniently determine the solution at the origin for both scalar and vector fields. They also discuss the Fourier method to approximate derivatives with respect to the angular variable in polar coordinates. Computational examples are presented illustrating the accuracy and efficiency of the method for hyperbolic and elliptic equations, and also for the computation of vector fields at the origin. GRA

N86-32195# Wisconsin Univ., Madison.
THE COMPUTATIONAL COST OF SIMPLEX SPLINE FUNCTIONS Technical Summary Report
Thomas A. Grandine Mar. 1986 12 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-82-10950)
(AD-A167513; MRC-TSR-2926) Avail: NTIS HC A02/MF A01 CSCL 12/1

All computational schemes for simplex spline functions to date rely both on the recurrence relation for these functions and the standard construction of the simplex spline basis. Under these conditions, for numerical methods for computing simplex spline functions to be a useful as possible, it is necessary to find ways of implementing the recurrence relation as efficiently as possible. This paper shows that as efficiently as possible is still not very efficient. This implies that truly fast algorithms (which have not yet been developed) will have to either abandon the recurrence relation or the standard construction of the simplex spline basis. GRA

N86-32196# Wisconsin Univ., Madison. Mathematics Research Center.
MINIMAL SUPPORT FOR BIVARIATE SPLINES Technical Summary Report
Carl DeBoor and Klaus Hollig Feb. 1986 21 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-83-51187)
(AD-A167519; MRC-TSR-2918) Avail: NTIS HC A02/MF A01 CSCL 12/1

In earlier works the authors applied their results on box-splines to analyze the approximation properties of bivariate smooth piecewise polynomials on the three direction mesh. In this report they obtain similar results for the other natural triangulation of R sub 2 which is generated by four directions. In particular they extend their results of minimality of support which are useful for constructing bases with good computational properties. GRA

N86-32197# Wisconsin Univ., Madison. Mathematics Research Center.
ITERATIVE REFINEMENT OF THE METHOD OF MOMENTS Summary Report
George Miel Mar. 1986 7 p
(Contract DAAG29-80-C-0041)
(AD-A167537; MRC-TSR-2923) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is observed that Vorobyev's method of moments, because it is a specialized form of Galerkin's method, is easily accelerated by the use of Sloan's trick of taking first iterates. The improvement, which is nearly costless since it requires no new quantities, is illustrated in a numerical example. GRA

N86-32198# Wisconsin Univ., Madison. Mathematics Research Center.
POINTWISE A-PRIORI BOUNDS FOR STRONGLY COUPLED SEMILINEAR PARABOLIC SYSTEMS Summary Report
Reinhard Redlinger Mar. 1986 13 p
(Contract DAAG29-80-C-0041)
(AD-A167539; MRC-TSR-2925) Avail: NTIS HC A02/MF A01 CSCL 20/13

The prototype parabolic partial differential equation is the heat conduction equation. This paper deals with systems of parabolic equations. Such systems occur in many contexts in addition to heat conduction, e.g., biology, in nuclear reactor techniques, in economics, etc. Let the n-vector u denote the (unknown) solution of a system of n parabolic partial differential equations. An important question in the study of these systems is the boundedness of u. Many techniques and criteria have been developed to solve this problem if the system is weakly coupled, i.e., if the k sub th equation contains second order space derivatives of only u sub k, the k sub th component of u. If this is not the case, the system is said to be strongly coupled. This paper for a broad class of strongly

coupled parabolic systems pointwise boundedness of the solution u is established. GRA

N86-32199# International Centre for Theoretical Physics, Trieste (Italy).
PAINLEVE TEST FOR THE COMPLETE INTEGRABILITY OF BOGOMOLNY'S MONOPOLE EQUATION
A. RoyChowdhury and P. K. Chanda Sep. 1984 7 p
(DE85-703173; IC-84/176) Avail: NTIS (US Sales Only) HC A02/MF A01

We have made an analysis of the monopole equation of Bogomolny from the standpoint of Painleve test. The idea that any nonlinear partial differential equation admitting a Lax representation should conform to the criterion of the Painleve analysis seems to hold well in case of the Bogomolny equation. We have determined the position for resonances and have proved that at each of these the coefficients in the Forbenius type expansion of the gauge potentials do become arbitrary signalling the complete integrability of the system. DOE

N86-32200# Colorado Univ., Colorado Springs. Dept. of Computer Science.
INVESTIGATION OF THE MOVING FINITE ELEMENT METHOD AS PROPOSED BY A.J. WATHEN
R. F. Sincovec and S. Aslam 26 Feb. 1986 69 p Prepared for Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE86-009685; UCRL-15793) Avail: NTIS HC A04/MF A01

The Moving Finite Element (MFE) method is investigated for solving non-linear Partial Differential Equations (PDE's) in one dimension with particular emphasis on equations that develop steep fronts and shocks. The MFE method allows the computational finite element mesh to continuously move and adjust with time in order to be able to resolve such sharp features. Degeneracies arising from lack of curvature and element folding can lead to an indeterminate system of MFE equations. Two methods for handling these degeneracies are explored. One requires the use of penalty functions while the other provides a simple scheme for treating such degeneracies. Implicit and explicit time stepping procedures for solving the MFE equations are investigated. For systems of equations, use of one moving mesh for all components and separate moving mesh for each component is explored. DOE

N86-32201# Sandia National Labs., Albuquerque, N. Mex.
SOME EXPERIMENTS WITH NUMERICAL PIVOTING IN A CODE FOR SOLVING LARGE SPARSE STIFF SYSTEMS OF ODES
D. E. Salane Apr. 1986 17 p
(Contract DE-AC04-76DP-00789)
(DE86-010305; SAND-86-0716) Avail: NTIS HC A02/MF A01

The effect of pivoting in a code is examined for the solution of large sparse stiff systems of odes. Experiments with a recent code (DEBDFS) are presented. These experiments indicate that some pivoting for numerical stability is essential in these codes. DOE

N86-32202# Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica.
EQUIVALENCE BETWEEN THE METHODS INVOLVING FOURIER SERIES AND THE POISSON'S SUMMATION FORMULA AND EVALUATION OF A CLASS OF LATTICE SUMS IN ARBITRARY DIMENSIONS
M. Dias and A. N. Chaba 1985 9 p
(DE86-701919; UFPB-DF-10/85) Avail: NTIS (US Sales Only) HC A02/MF A01

The similarities between the Fourier series method and the Poisson's summation formula method are brought out by evaluating the lattice sum g(vector r) is the definitonal identity of the summation of vector tau exp(-lambda times the absolute value of vector r - vector tau)/the absolute value of vector r - vector tau over a Bravois lattice /vector tau/ in three dimensions, lambda and vector r being independent of vector tau. It is shown that the two approaches are actually equivalent by proving that the Poisson's summation formula (in any dimensionality) can, itself, be derived from the Fourier series method. An expression is also presented, ready for quick use, for a class of lattice sums, the summation of vector tau F(the absolute value of vector r - vector tau) over a Bravois lattice /vector tau/ in arbitrary dimensions. DOE

N86-32203# Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica.
ON THE GENERATION OF EQUIVALENT HAMILTONIANS
O. Espindola, N. L. Teixeira, and M. L. Espindola 1985 4 p
(DE86-701920; UFPB-DF-12/85) Avail: NTIS (US Sales Only) HC A02/MF A01

A new approach to the equivalence problem (in phase space) is presented. Given a Hamiltonian describing a system of particles with two degrees of freedom (and the corresponding Hamilton-Jacobi equation), it is shown how to find the most general new Hamilton-Jacobi equation with the following (and essential) characteristic, here defined as equivalence: every new solution is also a solution of the original Hamilton-Jacobi equations and vice-versa. DOE

N86-32204# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
ONE-PARAMETER FAMILIES OF OPTIMIZATION PROBLEMS: EQUALITY CONSTRAINTS, 2
H. Th. Jongen, P. Jonker, and F. Twilt 1984 25 p Extended version
(Memo-420; ESA-86-97359) Avail: NTIS HC A02/MF A01

A differentiable optimization problem under generic regularity conditions is studied. The critical points in parametric optimization are generalized. This method can be extended to problems with inequality constraints. ESA

N86-32205# Grenoble-1 Univ. (France).
TRUNCATED CARDINAL SPLINE FUNCTIONS Ph.D. Thesis [FONCTIONS SPLINE CARDINALES TRONQUEES]
Rekha Panditrao Kulkarni 1985 162 p In FRENCH
(ESA-86-97284) Avail: NTIS HC A08/MF A01

The development of an optimal algorithm, in the sense of minimal cost and memory occupation, which has at the same time a high order of convergence, is investigated. It is shown that boundary conditions can be chosen to obtain such an algorithm. The boundary conditions proposed by Laurent are discussed. By choice of parameters the inverse of the Toplitz three diagonal matrix is reduced to a simple form. The truncation of the infinite sums leaves a truncated cardinal spline function, and the way to compensate for the truncation error is described. The technique used is applicable to polynomial spline functions of any degree. ESA

N86-32206# Grenoble-1 Univ. (France).
FLOW AND CYCLE COVERING IN GRAPHS AND MATROIDS Ph.D. Thesis [FLOTS ET COUVERTURES PAR DES CYCLES DANS LES GRAPHES ET LES MATROIDES]
Andre Raspaud 1985 120 p In FRENCH
(ESA-86-97285) Avail: NTIS HC A06/MF A01

Given a graph without isthmuses, the problem of finding the shortest length of cycle covering is studied. The Tarsi generalization of cycle covering to regular matroids is reviewed. The existence of non zero flows in a graph allows the improvement of the computation of a minimum length of cycle covering. Non zero flows are defined in binary spaces, for which the improvement is computed without reference to the orientation concept. The general problem of the existance of non zero flows is approached without using the maximum tree concept. The existence for the case of a four edges connected graph is proved. ESA

N86-32207# Grenoble-1 Univ. (France).
SPLINE FUNCTIONS WITH FORM CONDITIONS Ph.D. Thesis [FONCTIONS SPLINES AVEC CONDITIONS DE FORME]
Julio Medina 1985 277 p In FRENCH
(ESA-86-97286) Avail: NTIS HC A13/MF A01

The data interpolation and data smoothing problems are studied

for the case where form conditions are imposed, including positivity, monotony and convexity. The investigated methods include polynomial splines, rational splines, splines under tension, mathematical programming and splines with a rejection device. The smoothing problem is treated using a variational approach. The advantages offered by selected spline functions are shown. ESA

N86-32208# Institut National Polytechnique, Grenoble (France).
NETWORK IMPROVING BY SUBGRADIENT METHODS Ph.D. Thesis [AMELIORATION DE MAILLAGES PAR DES METHODES DE SOUS-GRADIENT]
Charles Cua 1985 143 p In FRENCH
(ESA-86-97293) Avail: NTIS HC A07/MF A01

Finite element network definition is studied to improve an existing network without changing the actual tetrahedron topology. The classical operations research optimization approach is proposed, using a set of general and algorithmic methods known as subgradient method. The resulting algorithm is tested on real cases from the aerospace industry. It is shown that the method has advantages over other algorithms for convex programming. ESA

N86-32209# Institut National Polytechnique, Grenoble (France). Lab. TIM 3.
ELEMENTARY FUNCTIONS COMPUTING METHODOLOGY Ph.D. Thesis [METHODOLOGIES DE CALCUL DES FONCTIONS ELEMENTAIRES]
Jean-Michel Muller 1985 171 p In FRENCH
(ESA-86-97298) Avail: NTIS HC A08/MF A01

A general computing theory valid for any number base is presented. The discrete base theory allows the construction of algorithms using addition, subtraction, and number shifts only, in any number base, to compute any elementary function such as log exp or cos. The Volder and Walther algorithms are reduced to a particular case of this generalization. Argument reduction techniques are also discussed. The method is used in the implementation of the FELIN (Integrated Elementary Functions) coprocessor being developed to work with the Motorola 68000 microprocessor. ESA

N86-32210# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
NOTE ON THE FACTORIZATION OF A SQUARE MATRIX INTO TWO HERMITIAN OR SYMMETRIC MATRICES
A. J. Bosch Apr. 1984 7 p
(ESA-86-97306) Avail: NTIS HC A02/MF A01

Seven properties of the factorization of a square matrix into two (Hermitian or symmetric) matrices are presented. An example in differential equations is given. ESA

N86-32211# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
POLYNOMIAL MATRICES AND FEEDBACK
Rikus Eising Mar. 1984 21 p
(Memo-COSOR-84-01; ESA-86-97308) Avail: NTIS HC A02/MF A01

A numerically reliable method for the construction of a feedback matrix solving the generalized deadbeat control problem is presented. The method of total unimodularity of the corresponding technology matrix, which implies integer solution, is used. The use of feedback with respect to polynomial matrix constructions is described. Good and bad solutions with respect to singular values are discussed. ESA

N86-32212# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computer Science.
AN ALGORITHM FOR THE EVALUATION OF PERFORMANCE MEASURES IN A CP-TERMINAL SYSTEM
J. B. M. vanDoremalen Nov. 1984 20 p
(Memo-COSOR-84-07; ESA-86-97310) Avail: NTIS HC A02/MF A01

The measures in a CP-terminal with stochastically independent thinktimes which are negative exponentially distributed, and the service times for jobs stochastically independent are considered. An algorithm for evaluation of performance measures in a CP-terminal system with preemptive resume priorities is discussed. The recursive scheme is used. ESA

N86-32213# Technische Hogeschool Twente, Enschede (Netherlands). Center for Theoretical Physics.
BREAK-UP OF INVARIANT CIRCLES FOR A MAPPING WITH A CUBIC NONLINEARITY
Cornelis Huiszoon Jul. 1984 21 p Sponsored by Stichting Hogeschoolfonds Twente, The Netherlands, K.I.V.I., and Physical Dynamics Inc., San Diego, Calif.
(Contract DE-AC03-77ER0153S)
(ESA-86-97378) Avail: NTIS HC A02/MF A01

The Poincare surface of section map (PSSM) for an energy conserving system with two degrees of freedom is considered. A constant value C, which a particular invariant circle of PSSM breaks, is determined. The symmetry properties of PSSM are given. A FORTRAN-77 code for estimating C values is listed. ESA

N86-32214# Fraunhofer-Inst. fuer Betriebsfestigkeit, Darmstadt (West Germany).
SEPARATION OF SUPPOSED STRESS-TIME FUNCTIONS BY FILTERING WITH VARIABLE CRITICAL FREQUENCY [TRENNUNG UEBERLAGERTER BEANSPRUCHUNGS-ZEIT-FUNKTIONEN DURCH FILTERUNG MIT VARIABLE GRENZ-FREQUENZ]
H. Klaetschke and H. Steinhilber 10 May 1985 34 p In GERMAN
(LBF-TB-174; ISSN-0721-5320; ESA-86-97414) Avail: NTIS HC A03/MF A01

A digital filter whose critical frequency can be controlled by the evolution of the stress within limits given by the user was developed and tested to separate the parts of stress-time functions according to their origin. The development of methods for the systematic generation of control signals for strength tests with servohydraulic machines using frequency filtering is discussed. The realization of variable critical frequencies is presented. Signal separation is explained by low and high pass filtering. Tests show that good results can be obtained with this method, even in difficult cases such as stepwise stress changes. ESA

N86-32215# Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.
ON ASYMPTOTIC ERROR ESTIMATES FOR THE COMBINED BOUNDARY AND FINITE ELEMENT METHOD
Wolfgang L. Wendland . Sep. 1985 16 p Submitted for publication
(Preprint-929; ESA-86-97427) Avail: NTIS HC A02/MF A01

The asymptotic error estimates for combined finite element method (FEM) and boundary element method (BEM) are considered. This approach is applied to general equations and other problems when the coupling operator between FEM and BEM is the identity modulo of compact perturbations. ESA

N86-32216# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
WHY THE STRAIGHTFORWARD METHOD OF ANTITHETIC VARIATES IS SO DISAPPOINTING IN PRACTICE
Johannes H. J. Geurts Mar. 1985 18 p
(ESA-86-97694) Avail: NTIS HC A02/MF A01

The effect of stochastic variables on systems simulation models (e.g., time between failures of a machine in a job shop) is discussed. Examples where the response consists of a number that is the direct result of passing a single random number through a sequence of monotonic transformations (the simulation model) are analyzed. Results show that the success of the straightforward application of the antithetic method depends on how well the initial pairwise symmetry of antithetic uniform random variables survives the concatenation of transformations that constitute a simulation model. Even in simple examples results are less than hoped for. In realistic simulation models straightforward application of the antithetic method cannot guarantee an appreciable reduction of the variance

of the estimate of the mean response. Whether a reduction can be achieved at all has to be determined experimentally in each individual case. ESA

N86-32217# Nijmegen Univ. (Netherlands). Dept. of Informatics.
FUNCTIONAL TEMPORAL CALCULUS VERSUS TEMPORAL LOGIC: AN ENGINEERING APPROACH
Raymond T. Boute Mar. 1985 29 p
(Rept-59; ESA-86-97713) Avail: NTIS HC A03/MF A01

It is demonstrated that functional temporal calculus directly merges with the formalisms used in system theory, communication theory, stochastic processes, and concurrent programming. Functions, predicates, and logical operators are defined by natural extension from mappings between value domains to mappings between so-called temporal domains. The modal operators of temporal logic are replaced by temporal combinators (second-order functions) defined directly as mappings between temporal domains. With this semantic formulation, the usual model-theoretic arguments and the distinction between validity and provability are replaced by arguments in standard (nonmodal) logic, while retaining all advantages of temporal logic, particularly the possibility of dealing with time implicity. The demonstration of this correspondence leads to redefinitions of concepts from temporal logic, constituting a nontrivial generalization of their syntactic counterparts. The flexibility of the semantic formulation leads to extensions such as continuous-time temporal calculus. ESA

N86-32218# Amsterdam Univ. (Netherlands). Facultaire Vakgroep Informatica.
READY TRACE SEMANTICS FOR PROCESS ALGEBRA WITH PRIORITY OPERATOR [READY TRACE SEMANTIEK VOOR PROCESALGEBRA MET PRIORITEITSOPERATOR]
J. C. M. Baeten, J. A. Bergstra, and J. W. Klop Dec. 1985 12 p in DUTCH Submitted for publication Sponsored by European Economics Commission ESPRIT Project 432
(FVI-85-15; B8660719; ESA-86-97744) Avail: NTIS HC A02/MF A01

A semantics for processes between bisimulation semantics and ready semantics is presented. The advantage of this semantics, while still being as simple as ready semantics, is that it allows the user to define the mechanism in which atomic actions have priority. It is shown that in ready semantics (and a fortiori in failure semantics) such an extension is not possible. Only ready trace semantics in concrete process algebra are considered, and thus not abstractness and quiet step. Only finite processes are considered. A complete axiomatization of ready trace semantics is given. ESA

N86-32219# Fondazione Ugo Bordoni, Rome (Italy).
EVALUATION OF SOME FIBONACCI AND LUCAS SERIES VIA CERTAIN FUNCTIONS OF THE Q MATRIX
Piero Filipponi Oct. 1985 12 p
(FUB-23-1985; ESA-86-97886) Avail: NTIS HC A02/MF A01

The analysis supposes a two by two matrix X, the entries of the successive powers of which are related to certain Fibonnaci or Lucas numbers. The X matrix is strictly related to the well known Q matrix. The functions exp X, sin X, cos X, sinh X, cosh X, inverse X and ln X are considered. The polynomial representation of function of two by two matrices with distinct eigenvalues is examined. The results obtained for each case are presented. ESA

N86-32220# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
ELEMENTARY SYMMETRIC POLYNOMIALS OF INCREASING ORDER
A. J. vanEs and R. Helmers Jan. 1986 13 p
(CWI-MS-R8601; B8664687; ESA-86-98053) Avail: NTIS HC A02/MF A01

The asymptotic behavior of elementary symmetric polynomials Sn of order k, based on n independent and identically distributed random variables X1, ..., Xn, is investigated for the case that both k and n get large. If k = 0micron (sq root n) the distribution function of a suitably normalized Sn of order k is shown to converge to a standard normal limit. The speed of this convergence to normality is of order 0 (k sq root n) if k = O (log (-1) n log2 (-1) n sq root n) and natural moment assumptions are imposed. This order bound is sharp, and cannot be inferred from one of the existing Berry-Esseen bounds for U-statistics. if k tends to infinity at the rate sq root n, then a non-normal weak limit appears, if the Xj's are positive and Sn(k) is standardized appropriately. If k tends to infinity at a rate faster than sq root n, it is shown that for positive Xj's there exists no linear norming which causes Sn(k) to converge weakly to a nondegenerate weak limit. ESA

N86-32008*# Little (Arthur D.), Inc., Cambridge, Mass.
MEASURES OF MEASUREMENT ADEQUACY
In its System Study of the Utilization of Space for Carbon Dioxide Research Oct. 1985 14 p (For primary document see N86-32005 23-46)
Avail: NTIS HC A23/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-32221# Grenoble-1 Univ. (France).
STATISTICAL ANALYSIS OF NONHOMOGENEOUS POISSON PROCESSES. STATISTICAL TREATMENT OF A PARTICLE MULTIDETECTOR Ph.D. Thesis [ANALYSE STATISTIQUE DE PROCESSUS DE POISSON SPATIAUX ET NON HOMOGENE. TRAITEMENT STATISTIQUE D'UN MULTIDETECTEUR DE PARTICULES]
Jean-Pierre Lacombe 1985 143 p In FRENCH
(ESA-86-97281) Avail: NTIS HC A07/MF A01

A procedure to test the intensity of nonhomogeneous Poisson processes is presented. The diffracted neutron intensities obtained in monocrystal diffraction using a two dimensional neutron multidetector are estimated using the mentioned statistical tools. For individual titles, see N86-32222 through N86-32223.

N86-32222# Grenoble-1 Univ. (France).
STATISTICAL ANALYSIS OF NONHOMOGENEOUS POISSON PROCESSES Ph.D. Thesis [ANALYSE STATISTIQUE DE PROCESSUS DE POISSON SPATIAUX ET NON HOMOGENE]
In its Statistical Analysis of Nonhomogeneous Poisson Processes. Statistical Treatment of a Particle Multidetector 1985 p 1-47 In FRENCH (For primary document see N86-32221 23-65)
Avail: NTIS HC A07/MF A01

A procedure to test the intensity of nonhomogeneous Poisson processes is presented. The test defined by Mark Brown is generalized to the set of Radon measures. The necessary and sufficient conditions for the existence of the Radon-Nikodym derivative of one or another Poisson law are investigated. The Neyman-Pearson theorem provides a solution to the hypothses test problem. It is proved that a multiple hypothesis test can be defined, and the conditions for which the test statistics are normal asymptotic are established. ESA

N86-32223# Grenoble-1 Univ. (France).
STATISTICAL TREATMENT OF A PARTICLE MULTIDETECTOR Ph.D. Thesis [TRAITEMENT STATISTIQUE D'UN MULTIDETECTEUR DE PARTICULES]
In its Statistical Analysis of Nonhomogeneous Poisson Processes. Statistical Treatment of a Particle Multidetector 1985 p 48-135 In FRENCH (For primary document see N86-32221 23-65)
Avail: NTIS HC A07/MF A01

The estimation of diffracted intensities from the diagrams obtained using a neutron diffractometer for monocrystals is studied. The instrument is gas filled, multifilament, with 64 anodes and 16 cathodes. The diffraction diagram is two dimensional over 1024 measuring points. The procedures to test the homogeneity and stability of the counting process are developed using a homogeneous flow of particles. The computation of the diffracted intensities

is done using two different methods depending on the background noise level. A nonhomogeneous Poisson process model is adopted. The computer program and the numerical results are included. ESA

N86-32224# Wisconsin Univ., Madison. Mathematics Research Center.
UPPER BOUNDS ON POISSON TAIL PROBABILITIES Summary Report
Peter W. Glynn Apr. 1986 13 p
(Contract DAAG29-80-C-0041; Grants NSF ECS-84-04809; NSF DMS-82-10950)
(AD-A167531; MRC-TSR-2931) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let p(k) = exp(-lambda) lamda sub k/k (k= 0,1,...) be the Poisson mass function. In a variety of application contexts, it is necessary to computer infinite sums involving these probabilities. For example, such sums occur naturally in numerical algorithms developed for Poisson variate generation purposes and for computing terminal rewards of uniformizable continuous-time Markov chains. From a practical standpoint, it is necessary to truncate these infinite sums after a finite number of terms. Development of a priori error bounds on the error incurred by this kind of truncation requires bounds on the left and right tails of the Poisson distribution; such bounds are given here. These bounds are easily computable in a numerically stable way, even when the Poisson parameter lambda is large. GRA

N86-32225# Wisconsin Univ., Madison. Mathematics Research Center.
THE CENTRAL LIMIT THEOREM AND POINCARE-TYPE INEQUALITIES Summary Report
Louis H. Y. Chen Apr. 1986 13 p
(Contract DAAG29-80-C-0041)
(AD-A167534; MRC-TSR-2929) Avail: NTIS HC A02/MF A01 CSCL 12/1

We use Poincare type inequalities to prove the sufficiency and necessity of the Lindeberg condition in the central limit theorem. The central limit theorem is a fundamental theorem in probability and statistics. It states that the probability distribution of the sum of a large number of small and mutually independent random numerical observations approaches a normal distribution as the number of observations increases. The Lindeberg condition is a condition for which the central limit theorem holds. It has been proved to be both necessary and sufficient. A Poincare type inequality is an inequality which relates the integral of the square of a function to the integral of the square of its derivative. In this report we give a new proof of the central limit theorem by using Poincare type inequalities to prove both the necessity and sufficiency of the Lindeberg condition. GRA

N86-32226# Oak Ridge National Lab., Tenn.
FOUNDATIONS OF O-THEORY 1: THE INTERSECTION RULE
E. M. Oblow Mar. 1986 32 p
(Contract DE-AC05-84OR-21400)
(DE86-008565; ORNL/TM-9983) Avail: NTIS HC A03/MF A01

O-theory (OT) is a hybrid uncertainty theory which has been proposed for dealing with problems of uncertainty in logical inference. The foundations of one of the concepts of OT, the OT intersection operator, are explored in this paper. It is shown that a more fundamental basis for the OT rule is classical probability theory. Mass assignments in the Dempster-Shafer theory (DST) formalism are first reevaluated yielding a more basic relationship between masses and probabilities. These results are then used to show that the OT intersection rule can be derived from first principles in probability theory. A simpler axiomatic basis can then be used to establish this rule. It can, therefore, be used as alternative to Bayes' theorem for combining probabilistic belief consistently. Dempsters' rule will be shown to be a special case of the OT result. It too will be derived from probability theory axioms. DOE

N86-32227# Grenoble-1 Univ. (France).
METHODS FOR THE DETECTION AND ESTIMATION OF MULTIPHASE REGRESSION MODELS Ph.D. Thesis [METHODES APPLIQUEES DE DETECTION ET D'ESTIMATION DE RUPTURE DANS DES MODELES DE REGRESSION]
Yacine Saidi 1986 108 p In FRENCH
(ESA-86-97282) Avail: NTIS HC A06/MF A01

The detection of the exitance of change points and parameter identification in multiphase regressions are studied. With the help of simulations the boundary function is determined to define the sum test critical region. The empirical study of the test power is done by varying the two parameters which characterize the phase change: the location of the change point and the amplitude of the change. The test of the maximum likehood rate is then studied. It is shown by means of a simple regression model how to compute the law of the test statistics. The Hinkley estimation techniques are discussed and developed. A case study is presented to show the application of both methods. The example analyzes the multiphase correlation between depth and flow of a river. ESA

N86-32228# Grenoble-1 Univ. (France).
ESTIMATING PROBLEMS IN STATIONARY TIME SERIES WITH MISSING DATA Ph.D. Thesis [PROBLEMES D'ESTIMATION DANS LES SERIES TEMPORELLES STATIONNAIRES AVEC DONNEES MANQUANTES]
Salim Ladjouze 1986 131 p In FRENCH
(ESA-86-97287) Avail: NTIS HC A07/MF A01

The problem is approached introducing amplitude modulated processes. The ergodic properties are studied in the frame of stationary asymptotic processes. The consistance of two estimators of the covariance function and the asymptotic variance are studied in the nonparametric domain. A general estimation method of the spectral density function is presented. The bias and the maximum likelihood of the estimating procedure are discussed. Parametric estimation methods based on spectra and maximum likelihood are also presented. ESA

N86-32229# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
A COMPARISON OF PLOTTING POSITIONS ON WEIBULL PROBABILITY PAPER FOR SMALL RANDOMLY CENSORED SAMPLES
Johannes H. J. Geurts Jan. 1985 38 p
(ESA-86-97695) Avail: NTIS HC A03/MF A01

Methods to calculate probability plotting positions from randomly censored samples are compared: Herd's (1960) expected rank method, Nelson's (1969) hazard method and a method described by Chambers' et al (1983). Though the average differences between the methods appear to be small compared to the sampling fluctuations, they are persistent enough to recommend Herd's or Nelson's method for use with Weibull probability paper. ESA

N86-32230# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
CHAINS WITH INFINITE CONNECTIONS: UNIQUENESS AND MARKOV REPRESENTATION
H. C. P. Berbee Nov. 1985 12 p Submitted for publication
(CWI-MS-R8509; B8664688; ESA-86-98052) Avail: NTIS HC A02/MF A01

Under a well-known continuity condition on the conditional distribution, the chain with infinite connections is shown to be distributed as an instantaneous function of a countable state Markov chain. Under a certain weaker continuity condition, uniqueness of the distributions of the stationarry chains is obtained. ESA

N86-32231# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
ON DELTA BETA AND THE SEARCH FOR ASYMPTOTIC SCALING IN LATTICE GAUGE THEORY
D. Petcher Jan. 1986 25 p
(NIKHEF-H/86-6; B8665342; ESA-86-98057) Avail: NTIS

HC A02/MF A01

An ansatz for the Beta function of SU(3) lattice gauge theory in 4 dimensions whose parameters are determined by Monte Carlo data is used to compare different sets of data for Delta Beta and to study systematic errors. The data for Delta Beta obtained from different values of the block spin renormalization group scaling factor are shown to be compatible within statistical errors. However the data is easily consistent with sizeable deviations (30% or more) from the two loop approximation to the renormalization group scaling formula for physical quantities in the region of coupling for which Delta Beta essentially takes on its asymptotic value. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-32232*# Mississippi State Univ., Mississippi State.
SYSTEM ANALYSIS FOR THE HUNTSVILLE OPERATION SUPPORT CENTER DISTRIBUTED COMPUTER SYSTEM Final Report
F. M. Ingels Jun. 1986 115 p
(Contract NAS8-34906)
(NASA-CR-178890; NAS 1.26:178890) Avail: NTIS HC A06/MF A01 CSCL 12B

A simulation model of the NASA Huntsville Operational Support Center (HOSC) was developed. This simulation model emulates the HYPERchannel Local Area Network (LAN) that ties together the various computers of HOSC. The HOSC system is a large installation of mainframe computers such as the Perkin Elmer 3200 series and the Dec VAX series. A series of six simulation exercises of the HOSC model is described using data sets provided by NASA. The analytical analysis of the ETHERNET LAN and the video terminals (VTs) distribution system are presented. An interface analysis of the smart terminal network model which allows the data flow requirements due to VTs on the ETHERNET LAN to be estimated, is presented. B.G.

N86-32233# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
MONOTONICALLY IMPROVING LIMIT-OPTIMAL STRATEGIES IN FINITE STATE DECISION PROCESSES
Theodore P. Hill and Jan vanderWal Dec. 1984 26 p Sponsored in part by NATO
(Grant NSF DMS-84-01604)
(Memo-COSOR-84-15; ESA-86-97312) Avail: NTIS HC A03/MF A01

The Markov strategy associated with the finite-state leavable gambling problem and the finite state Markov decision process with discontinued reward criteria are considered. An example to show that for positive and gambling cases such strategies cannot be constructed by simply switching to a better action or gamble at each successive return to a state is given. ESA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-32234# Wisconsin Univ., Madison. Mathematics Research Center.
A CONVERGENCE THEOREM FOR NEWTON-LIKE METHODS IN BANACH SPACES Technical Summary Report
Tetsuro Yamamoto Jan. 1986 19 p
(Contract DAAG29-80-C-0041)
(AD-A167455; MRC-TSR-2904) Avail: NTIS HC A02/MF A01 CSCL 12/1

A convergence theorem for Newton-like methods in Banach spaces is given, which improves results of Rheinboldt, Dennis, Miel and Moret and includes as a special case an updated version of the Kantorovich theorem for the Newton method given in previous papers. Error bounds obtained previously are also improved. This paper unifies the study of finding sharp error bounds for Newton-like methods under Kantorovich type assumptions. Author (GRA)

N86-32235# Wisconsin Univ., Madison. Mathematics Research Center.
THE NEUMANN PROBLEM FOR NONLINEAR SECOND ORDER SINGULAR PERTURBATION PROBLEMS Technical Summary Report
Benoit Perthame and Richard Sanders Jan. 1986 33 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-82-00676)
(AD-A167456; MRC-TSR-2905) Avail: NTIS HC A03/MF A01 CSCL 20/4

Singularly perturbed second order elliptic partial differential equations with Neumann boundary conditions arise in many areas of application. These problems rarely have smooth limit solutions. In this paper, the author characterize the limit solution for a wide class of such problems. They also give an abstract rate of convergence theorem and apply the abstract theorem to certain finite difference approximations. GRA

N86-32236# Wisconsin Univ., Madison. Mathematics Research center.
HAMILTON-JACOBI EQUATIONS IN INFINITE DIMENSIONS, PART 3 Summary Report
Michael G. Crandall and Pierre-Louis Lions Feb. 1986 47 p
(Contract DAAG29-80-C-0041)
(AD-A167521; MRC-TSR-2907) Avail: NTIS HC A03/MF A01 CSCL 20/4

This paper is concerned with a number of topics in the theory of viscosity solutions of Hamilton Jacobi equations in infinite dimensional spaces. The development of the theory in the generality in which the space or state variable lies in an infinite dimensional space is partly motivated by the hope of eventual applications to the theory of control of partial differential equations or control under partial observation. Among the results presented are: The existence and uniqueness theory previously discussed in spaces with the Radon Nikodym property is extended beyond this class; examples are given which show that Galerkin approximation arguments in their naive forms cannot be made the basis of an existence theory; some equations with unbounded terms of the sort that arise in control of pde's are treated by means of a change of variables reducing the problem to the previously studied cases. GRA

N86-32237# Wisconsin Univ., Madison. Mathematics Research Center.
THE HAMILTON-JACOBI-BELLMAN EQUATION WITH A GRADIENT CONSTRAINT Summary Report
Naoki Yamada Mar. 1986 24 p
(Contract DAAG29-80-C-0041)
(AD-A167532; MRC-TSR-2927) Avail: NTIS HC A02/MF A01 CSCL 12/1

As the first order Hamilton Jacobi equation is related to a control problem associated with ordinary differential equations, the Hamilton Jacobi Bellman (HJB) equation arises from a control problem with random noise. In the stationary problem, the HJB equation has the form sup when alpha is an element of A of (L(sup alpha)u - f(sup alpha)) = 0 where L superscript alpha are second order linear elliptic operators with parameter alpha an element of A. In this paper, we are concerned with the HJB equation of the form max(L(sup 1)u - f(sup 1),...,L(sup m) -f(sup m), the absolute value of Du - g) = 0. We prove the existence of solutions which satisfy the equation almost everywhere. Using the notion of weak solution (so called viscosity solution) we prove the uniqueness of the solution in the class of continuously differentiable functions. The method of the uniqueness proof is also applicable to other obstacle problems. We prove uniqueness results in the class of continuous functions for two model problems. GRA

N86-32238# International Centre for Theoretical Physics, Trieste (Italy).

MAPPINGS WITH CLOSED RANGE AND FINITE DIMENSIONAL LINEAR SPACES
S. O. Iyahen Sep. 1984 17 p
(DE85-703172; IC-84/167) Avail: NTIS (US Sales Only) HC A02/MF A01

This paper looks at two settings, each of continuous linear mappings of linear topological spaces. In one setting, the domain space is fixed while the range space varies over a class of linear topological spaces. In the second setting, the range space is fixed while the domain space similarly varies. The interest is in the requirement that the mappings have a closed range implies that the domain or range space is finite dimensional. Positive results are obtained for metrizable spaces. DOE

N86-32239# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
QUASI-PERIODIC SOLUTIONS OF THE BOOMERON EQUATION
R. Martini and W. Wesselius May 1984 15 p
(Memo-436; ESA-86-97362) Avail: NTIS HC A02/MF A01

The quasi-periodic solution of the Boomeron equation (a nonlinear differential equation) is considered. The representations of Lax of the Boomeron equation are discussed. The theta function over Riemann surfaces is used. ESA

N86-32240# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
QUASI-PERIODIC SOLUTIONS OF THE BOOMERON EQUATION, 2
R. Martini and W. Wesselius May 1984 22 p
(Memo-472; ESA-86-97367) Avail: NTIS HC A02/MF A01

The quasi-periodic solutions of the Boomeron equation (a nonlinear differential equation) are determined by means of function-theoretical methods related to Riemann surfaces and Theta-functions. Also determined are the so-called boomerons as degenerations of the quasi-periodic solutions. Moreover it is indicated that there are no higher order Boomeron equations other than the second order one. M.G.

N86-32241# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
AN INTERATIVE APPROXIMATION METHOD FOR THE CALCULATION OF THE BALANCE DISTRIBUTION FOR A FINITE MARKOV CHAIN Thesis [EEN ITERATIEVE BENADERINGSMETHODE VOOR DE BEREKENING VAN DE EVENWICHTSVERDELING BIJ EEN EINDIGE MARKOV-KETEN]
M. F. L. vanNielen Nov. 1984 82 p In DUTCH
(ESA-86-97303) Avail: NTIS HC A05/MF A01

Two iteration methods to approximate the balance distribution of irreducible aperiodic Markov chains with a successive approximation technique were developed. The balance distribution is important for the solution of problems concerning communication and computer networks. The advantage of the pre-Jacobi and Gauss-Seifdel iteration methods is the possibility to calculate lower and upper limits of the balance distribution. The techniques were numericaly tested with queueing problems. The Gauss-Seidel method is faster for the calculation of converging limits than the pre-Jacobi or vector iteration method. ESA

N86-32242*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHIMERA: A GRID-EMBEDDING TECHNIQUE Final Report, 1 Nov. 1980 - 1 Oct. 1985
J. A. Benek (Calspan Advanced Technology Center, Buffalo, N.Y.), J. L. Steger, F. C. Dougherty, and P. G. Buning Apr. 1986 112 p Prepared in cooperation with AEDC
(NASA-TM-89246; NAS 1.15:89246; AD-A167466; AEDC-TR-85-64) Avail: NTIS HC A06/MF A01 CSCL 09/2

A three-dimensional chimera grid-embedding technique is described. The technique simplifies the construction of computational grids about complex geometries. The method subdivides the physical domain into regions which can accommodate easily generated grids. Communication among the grids is accomplished by interpolation of the dependent variables at grid boundaries. The procedures for constructing the composite mesh and the associated data structures are described. The method is demonstrated by solution of the Euler equations for transonic flow about three ellipsoid bodies in close proximity, a wing/body, and a wing/body/tail. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-32243# Wisconsin Univ., Madison. Mathematics Research Center.
STEADY-STATE PROBLEMS OF NONLINEAR ELECTRO-MAGNETO-THERMO-ELASTICITY Technical Summary Report
Robert C. Rogers and Stuart S. Antman Jan. 1986 70 p
(Contract DAAG29-80-C-0041; Grants NSF DMS-85-03317; NSF dMS-82-10950)
(AD-A167454; MRC-TSR-2903) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper studies the steady-state behavior of solids that can sustain mechanical, electromagnetic, and thermal effects. The authors examine a class of boundary-value problems for a quasilinear system of functional differential equations that is derived from a very general model for such materials. They propose a physically reasonable constitutive theory which leaves this system amenable to modern methods of partial differential equations. The principal assumption is a modified version of the strong ellipticity condition. Part I proves existence results for the general system under some special physical assumptions (rigidity and hyperelasticity). The formulation admits non-iocal interactions caused by the magnetic self-field generated by the deformed, conducting body. Part II shows the existence and regularity of solutions of a system of functional ordinary differential equations arising from a semi-inverse problem in a more comprehensive physical situation. Author (GRA)

N86-32244# Wisconsin Univ., Madison.
ON L SUB 1-CONTRACTION FOR SYSTEMS OF CONSERVATION LAWS Technical Summary Report
Jorge G. S. Patino Feb. 1986 11 p
(Contract DAAG29-80-C-0041)
(AD-A167484; MRC-TSR-2917) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Cauchy problem for a 2 x 2 system of conservation laws in one dimension is u sub t + (f(u)) sub x = 0, x epsilon R, t greater than 0 u(x,0) = u sub 0 where u = (u sub 1, u sub 2), f = (f1 (u), f sub (u)). Such systems of equations usually come from the application of the laws of conservation for physical quantities like mass, momentum and energy, and arise in problems of gas dynamics, elasticity, oil reservoir simulation and other areas of engineering. The questions of decay and continuous dependence with respect to the initial data are central issues in the study of the problem above. The result proved here rules out the use of certain functionals to study the decay of solutions and is relevant to the issue of L sub 1 continuity with respect to the data. GRA

N86-32245# International Atomic Energy Agency, Vienna (Austria).
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS: SCIENTIFIC ACTIVITIES IN 1984
Sep. 1985 93 p
(DE86-701454; IAEA-TECDOC-353) Avail: NTIS (US Sales Only) HC A05/MF A01

A review of the scientific activities of the Centre, including workshops, research, and training-for-research is presented. The scientific program consists of seven main fields, Physics and Energy, Fundamental Physics, Physics and Technology, Physics of the Living State, Physics of the Environment, Physics and Development, and Mathematics. In addition to a brief description

of each workshop, symposium, college, and meeting, tables summarizing the participation at ICTP activities are given. A list of preprints and internal reports issued in 1984 is included. DOE

N86-32246# Stichting voor Fundamenteel Onderzoek der Materie, Utrecht (Netherlands).
[ACTIVITIES REPORT IN FUNDAMENTAL RESEARCH ON MATTER] Annual Report, 1984 [JAARBOEK 84]
1985 155 p In DUTCH; ENGLISH summary
(ESA-86-97778) Avail: NTIS HC A08/MF A01

The activity reports in the fields of nuclear physics, atomic and molecular physics, physical and chemical properties of metals, solid state, thermonuclear fusion and plasmaphysics, theoretical high energy physics and semiconductors are presented. ESA

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-32247*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF TRIANGULAR ELEMENT ORIENTATION ON FINITE ELEMENT SOLUTIONS OF THE HELMHOLTZ EQUATION
Kenneth J. Baumeister 1986 23 p Proposed for presentation at the 1986 Winter Annual Meeting of the American Society of Mechanical Engineers, Anaheim, Calif., 7-12 Dec. 1986
(NASA-TM-87351; E-2734; NAS 1.15:87351) Avail: NTIS HC A02/MF A01 CSCL 20A

The Galerkin finite element solutions for the scalar homogeneous Helmholtz equation are presented for no reflection, hard wall, and potential relief exit terminations with a variety of triangular element orientations. For this group of problems, the correlation between the accuracy of the solution and the orientation of the linear triangle is examined. Nonsymmetric element patterns are found to give generally poor results in the model problems investigated, particularly for cases where standing waves exist. For a fixed number of vertical elements, the results showed that symmetric element patterns give much better agreement with corresponding exact analytical results. In laminated wave guide application, the symmetric pyramid pattern is convenient to use and is shown to give excellent results. Author

N86-32248*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SOUND PROPAGATION OVER UNEVEN GROUND AND IRREGULAR TOPOGRAPHY Semiannual Status Report
Allan D. Pierce, Geoffrey L. Main, James A. Kearns, Daniel R. Benator, and James R. Parish, Jr. Feb. 1986 58 p
(Grant NAG1-566)
(NASA-CR-179673; NAS 1.26:179673) Avail: NTIS HC A04/MF A01 CSCL 20A

The development of theoretical, computational, and experimental techniques for predicting the effects of irregular topography on long range sound propagation in the atmosphere is discussed. Irregular topography here is understood to imply a ground surface that (1) is not idealizable as being perfectly flat or (2) that is not idealizable as having a constant specific acoustic impedance. The study focuses on circumstances where the propagation is similar to what might be expected for noise from low-altitude air vehicles flying over suburban or rural terrain, such that rays from the source arrive at angles close to grazing incidence. Author

N86-32249# Naval Underwater Systems Center, New London, Conn.
MEASUREMENT AND EXTRACTION OF RECURRING WAVEFORMS: FOR APPLICATIONS TO ACTIVE TRANSMISSIONS, FLOW-NOISE, AND HELICOPTER-RADIATED NOISE PROBLEMS
Roger F. Dwyer 24 Mar. 1986 39 p
(AD-A167400; NUSC-TM-861043) Avail: NTIS HC A03/MF A01 CSCL 20/1

Physical acoustic sources that radiate transient waveforms represent a large class of noise generators. Active transmissions, flow-noise, and helicopter-radiated noise under certain flight situations depending on the source-observer orientation are members of this class. The objective of this paper is to present a signal processing methodology to extract time domain recurring waveforms from data. The recurring waveforms, on the one hand, may represent a source of interference that is to be eliminated as much as possible. But, on the other hand, these recurring waveforms may represent a desired signal that is to be extracted from a background of undesired noise. Both cases are shown in the paper to be different aspects of the same problem. Initially, the methodology is based on a physical property of equally spaced and identical recurring waveforms. These results are then generalized, because in practice, either by design or by other causes, the recurring waveforms may not be equally spaced and identical. The method is then applied to extract equally spaced and nearly identical waveforms which were produced by an approaching helicopter. Author (GRA)

N86-32250# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
VERTICAL DIRECTIONALITY OF AMBIENT NOISE: 150-300 Hz
W. S. Hodgkiss and F. H. Fisher 7 Feb. 1986 74 p
(Contract N00014-84-K-0097)
(AD-A167421; MPL-TM-381; MPL-U-7/86) Avail: NTIS HC A04/MF A01 CSCL 17/1

Measurements of the vertical directionality of ambient noise in the 150-300 Hz region have been reported. The 48 element NORDA VEKA array cut for 300 Hz and centered on the sound axis (750 m) was used to collect the data. Three features of the data are striking: (1) short term stability and long term fluctuations of the vertical structure, (2) asymmetry in the levels observed by the upward and downward looking beams, and (3) the existence of an underlying boxcar characteristic to the vertical structure on top of which are substantial fluctuations often taking the form of horns at + or - 10-14 degrees with a significant notch in the + or - 9-10 degrees region. GRA

N86-32251# Cambridge Collaborative, Inc., Mass.
COMPENDIUM OF METHODS FOR APPLYING MEASURED DATA TO VIBRATION AND ACOUSTIC PROBLEMS Final Report, Aug. 1980 - Jul. 1985
R. G. DeJong Oct. 1985 564 p
(Contract F33615-80-C-3200)
(AD-A168174; Rept-23016-85-1; AFWL-TR-85-3080) Avail: NTIS HC A24/MF A01 CSCL 01/1

The scope of this report includes the measurement, analysis and use of vibration and acoustic data. The purpose of this report is then two-fold. First, it provides introductory material in an easily understood manner to engineers, technicians, and their managers in areas other than their specialties relating to the measurement, analysis and use of vibration and acoustic data. Second, it provides a quick reference source for engineers, technicians and their managers in the areas of their specialties relating to the measurement, analysis and use of vibration and acoustic data. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-32252# Netherlands Energy Research Foundation, Petten.
ON THE STATISTICAL EVALUATION OF INCONSISTENT MEASUREMENT RESULTS ILLUSTRATED ON THE EXAMPLE OF THE Sr 90 HALF LIFE
Willem L. Zijp Dec. 1985 29 p
(ECN-179; B8660552; ESA-86-97735) Avail: NTIS HC A03/MF A01

Evaluation of inconsistent numerical observations made by different authors or laboratories on the same physical quantity is treated. It is argued that the weighted mean based on conventional

weighting is heavily influenced by the value of the extremely small standard deviation stated by the experimenter. The method of Gray (1985) based on adjustment of relative information gives a value close to the unweighted mean, and a standard deviation which is smaller than for the unweighted case. The approach of limitation of statistical weights gives smaller values. The extended variance weighting and its improvement in the form of iterative weighting give results close to the results for the unweighted mean. ESA

N86-32253# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
HIGH STATISTICS INCLUSIVE PHI MESON PRODUCTION AT SPS ENERGIES
H. Dijkstra, R. Bailey (Science Research Council, Chilton (England).), E. Belau (Max-Planck-Inst. fuer Physik und Astrophysik, Munich (West Germany).), T. Roehringer (European Organization for Nuclear Research, Geneva (Switzerland).), M. Bosman, V. Chabaud, C. Damerell (Science Research Council, Chilton (England).), C. Daum, G. deRijk, S. Gill et al 1986 26 p Submitted for publication
(NIKHEF-H/86-1; B8665339; ESA-86-98054) Avail: NTIS HC A03/MF A01

Inclusive phi meson production was measured for 100 GeV/c and 200 GeV/c incident pi(-) pbar and K (-), and for 120 GeV/c and 200 GeV/c incident pi (+), p and K (+), using a Be target. A total of 630,000 phi mesons were recorded in the kinematic range 0 less than x sub F less than 0.4. The differential cross sections d sigma/dx sub F and d sigma/dp sub T sq are presented. The longitudinal momentum distributions show that the strange valence quarks of the incident K mesons play an important role in phi meson production even at small sub f. The decay angular distribution of the phi meson is evaluated in the Gottfried-Jackson frame and is expressed in the elements of the density matrix. There is a small but significant cos sq theta Gottfried-Jackson dependence for small p sub T, which decreases for increasing P sub T. ESA

N86-32254# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
INCLUSIVE PHI MESON PRODUCTION, THE PARTON FUSION MODEL AND STRANGE QUARK STRUCTURE FUNCTIONS
H. Dijkstra, R. Bailey (Science Research Council, Chilton (England).), E. Belau (Max-Planck-Inst. fuer Physik und Astrophysik, Munich (West Germany).), T. Bohringer (European Organization for Nuclear Research, Geneva (Switzerland).), M. Bosman, V. Chabaud, C. Damerell (Science Research Council, Chilton (England).), C. Daum, G. deRijk, S. Gill et al 1986 14 p Submitted for publication
(NIKHEF-H/86-3; B8665340; ESA-86-98055) Avail: NTIS HC A02/MF A01

The parton fusion model is used to describe the longitudinal differential cross section of hadronic phi production. The cross section for phi production in pi (+or-) p, p (-) p, and K (+or-) p interactions is evaluated in the model by using structure functions for the constituents of the interacting particles. A comparison between the model and high statistics data in the Feynman x range 0 less than x sub F (phi) less than 0.4 allows the determination of the strange valence quark distribution in pi mesons, which appears to be harder than the light sea quark distribution. The comparison also shows that a significant part of inclusive phi production is due to the OZI allowed fusion of strange quarks, while the OZI inhibited fusion diagrams are strongly suppressed. ESA

N86-32255# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
HADRONIC PHI PRODUCTION AND THE LUND MODEL FOR LOW p SUB T INTERACTIONS
H. Dijkstra, R. Bailey, E. Belau, T. Boehringer, M. Bosman, V. Chabaud, C. Damerell, C. Daum, G. deRijk, S. Gill et al 1986 9 p Submitted for publication
(NIKHEF-H/86-4; B8665341; ESA-86-98056) Avail: NTIS HC A09/MF A01

Experimental results on inclusive phi production are compared with the Lund model for low p sub T hadronic interactions. The data is based on a sample of 600,000 phi mesons in the kinematic range p sub T less than 1.0 (GeV/c) sq and 0.0 less than x sub F less than 0.4, produced in pi (+or-), k (+or-), p and p Be interactions at 100 GeV/c and 120 GeV/c incident momentum. The Lund model reproduces the shapes of the longitudinal differential cross sections reasonably well, but the relative cross sections for incident pi, K and p show a discrepancy with the data. ESA

N86-32256# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
DEUTERON PROPERTIES STUDIED IN NEUTRINO AND ANTINEUTRINO INTERACTIONS
A. G. Tenner 1986 32 p
(NIKHER-H/86-7; B8664354; ESA-86-98058) Avail: NTIS HC A03/MF A01

Interactions of neutrinos and antineutrinos were studied in a deuterium bubble chamber. The spectrum of proton spectators was studied and compared with the predictions of different deuterium models. Rescattering was investigated. The spectrum of spectator protons may be explained from current deuteron models. To obtain agreement between the theory and the data, kinematical effects of the neutrino interactions have to be included. The results then show evidence for a diffractive component in deuteron rescattering. The slow protons produced in nu root nu/deuteron interactions can be separated into prompt protons, rescattering protons, and spectators. There is quantitative agreement with the predictions. No other sources of protons need to be considered. Results partly agree with the additive quark model of rescattering. No evidence is found for the excitation of a Delta (1236) resonance through pi (+) p rescattering. No evidence is found for the existence of a Delta-Delta structure of the deuteron. No evidence is found for deuterons in the final state of nu root nu deuteron interactions. ESA

N86-32257# Amsterdam Univ. (Netherlands). Faculteit der Wiskunde en Natuurwetenschappen.
A STUDY OF THE INTERACTIONS OF HIGH ENERGY ELECTRON-NEUTRINOS Ph.D. Thesis
Cornelis Hermanus Maria Nieuwenhuis 1986 100 p Sponsored by Stichting voor Fundamenteel Onderzoek der Materie
(ESA-86-98072) Avail: NTIS HC A05/MF A01

Data on electron-neutrino and antineutrino interactions with nuclei were collected with a calorimeter in a beam dump exposure to 400 GeV/c protons, to verify if the ratio of the flux of prompt electron-neutrinos and muon-neutrinos may deviate from unity. The cross-section ratio for NC/CC interactions of nue + nu bar e, Re = 0.40 +or- 0.12 (+or- 0.08 syst) is found in agreement with the known cross-section ratio R mu = 0.330 +or- 0.01 for nu mu + nu bar mu. This equality is predicted by the Standard Model of electroweak interactions. The prompt CC (nu (nu bar) e)/CC (nu (nu bar) mu) flux ratio is not in bad disagreement (1.8 standard deviations) with the Standard Model predictions under assumption of equal fluxes for nu e and nu bar e. The energy dependence of the prompt electron-neutrino flux agrees with a Monte Carlo prediction simulating DD bar production and semileptonic decay. The calculated DD bar cross-section times semileptonic branching ratio agrees with the results of other measurements of this quantity. ESA

N86-32352*# Rochester Univ., N. Y. Nuclear Structure Research Lab.
DETERMINATION OF CA-41, I-129 AND OS-187 IN THE ROCHESTER TANDEM ACCELERATOR AND SOME APPLICATIONS OF THESE ISOTOPES
U. Fehn, D. Elmore, H. E. Gove, P. Kubik, R. Teng, and L. Tubbs *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 20H

N86-32359*# California Univ., San Diego, La Jolla.
LIVE 129I-129Xe DATING
Kurt Marti *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-32258# Maryland Univ., College Park. Inst. for Physical Science and Technology.
ACCELERATION OF IONS AND ELECTRONS BY WAVE-PARTICLE INTERACTIONS Annual Summary Report, 1 Apr. - 30 Nov. 1985
C. S. Wu and John D. Gaffey, Jr. 30 Nov. 1985 10 p
(Contract N00014-85-K-0436)
(AD-A167631) Avail: NTIS HC A02/MF A01 CSCL 20/7

The research program is divided into four tasks; (1) Application of kinetic cross-field streaming instabilities to laboratory experiments; (2) Electromagnetic electron-cyclotron instability excited by hot electrons with a loss-cone distribution; (3) Induced emission of electromagnetic radiation near the second harmonic of the plasma frequency; (4) Effects of an electrostatic instability on the induced emission of electromagnetic radiation near 2 omega sub e. GRA

N86-32259# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
FOCUSED ION BEAM TECHNOLOGY
John Melngailis Oct. 1985 15 p
(Contracts MDA903-85-C-0215; DAAG29-83-K-0003)
(AD-A167762; VLSI-MEMO-85-275) Avail: NTIS HC A02/MF A01 CSCL 20/7

The finely focused ion beam is a new instrument with many uses. It can focus a beam of any one of many species of ions at energies up to 200 kV to dimensions below 0.1 micrometers. This capability can be used: to implant dopants in semiconductors in a maskless process, to mill away material and repair masks or circuits, to deposit material with submicron resolution if an appropriate local gas ambient is present, to perform lithography by exposing resist, and to analyze and examine specimens. There are about 30 sophisticated systems in operation world wide, about two thirds of them in Japan. The field is still in its infancy, and one can expect both improvements in machinery and many new applications to develop particularly in the area of custom semiconductor devices. GRA

N86-32260# Los Alamos National Lab., N. Mex.
SPACE NUCLEAR SAFETY PROGRAM Progress Report, Sep. 1984
T. G. George, comp. Feb. 1986 14 p
(Contract W-7405-eng-36)
(DE86-008579; LA-10630-PR) Avail: NTIS HC A02/MF A01

This technical monthly report covers studies related to the use of (238)PuO2 in radioisotope power systems conducted for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed are ongoing; the results and conclusions described may change as the work progresses. DOE

N86-32261# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Chemie.
CARBON MONOXIDE FORMATION IN UO2 KERNELED HTR FUEL PARTICLES CONTAINING OXYGEN GETTERS
Emil Proksch, Anton Strigl, and Heinz Nabielek Jan. 1986 25 p Submitted for publication
(OEFZS-4348; CH-358/86; ESA-86-97248) Avail: NTIS HC A02/MF A01

Mass spectrometric measurements of CO in irradiated UO2 fuel particles containing oxygen getters are summarized. Uranium carbide addition in the 3% to 15% range reduces the CO release by factors between 25 and 80, up to burn-up levels as high as 70% FIMA. Unintentional gettering by SiC in TRISO coated particles with failed inner pyrocarbon layers results in CO reduction factors between 15 and 110. For ZrC, ambiguous results are obtained; ZrC probably results in CO reduction by a factor of 40; Ce2O3 and La2O3 seem less effective than the carbides; for Ce2O3, reduction factors between 3 and 15 are found. However, the results are possibly incorrect due to premature oxidation of the getter already during fabrication. Addition of SiO2 + Al2O3 has no influence on CO release. ESA

N86-32262# British Petroleum Co. Ltd., Sunbury-on-Thames (England).
PETROPHYSICAL QUANTITIES FROM HIGH RESOLUTION GAMMA-RAY SPECTRA ARISING FROM ENERGETIC NEUTRON BOMBARDMENT
D. W. Mellor and M. C. Underwood 1985 27 p Presented at the 26th Annual Logging Symposium, Dallas, Tex., 17-20 Jun. 1985
(ESA-86-97256) Avail: NTIS HC A03/MF A01

A logging tool comprising a 5 Curie Am241-Be neutron source and n-type intrinsic germanium gamma ray detector was developed. A large calibration tank, in simulated well-bore geometry, comprising oil and water saturated sand, was constructed and was interrogated using the tool. In a separate experiment, oil zone material was irradiated using 14 MeV neutrons. An interpretational model that allows the porosity, oil and water saturation, matrix composition, and water salinity to be inferred is presented. This confirms that under strictly controlled experimental conditions, major petrophysical properties can be inferred from high resolution gamma ray spectra. ESA

N86-32263# Netherlands Energy Research Foundation, Petten.
INTEGRAL-DATA TEST OF JEF-1 FISSION-PRODUCT CROSS SECTIONS
A. J. Janssen, H. Gruppelaar, R. J. Heijboer, N. Karouby-Cohen, L. Martin-Deidier, G. Rimpault, and M. Salvatores Nov. 1985 145 p
(ECN-176; B8577863; ESA-86-97734) Avail: NTIS HC A07/MF A01

Integral data from STEK (5 cores), CFRMF, ZONA-1, RONA-3, and PHENIX were used to test the fast-capture fission product cross section evaluations of 60 materials. Experimental and calculated capture reactivity values in the five STEK cores for most of these nuclides are given. A correction for scattering based upon the original evaluation was made. There are indications that this correction is too small for even-mass isotopes due to the neglect of direct-collective effects in the inelastic scattering evaluations. This also follows from comparison with activation and irradiation measurements performed in CFRMF, ZONA-1, RONA-3, and PHENIX. A survey of all the results, expressed by the ratio of experimental to calculated values as a function of the relative response above 1 keV in the various assemblies, is presented. ESA

N86-32264# Netherlands Energy Research Foundation, Petten.
ON THE GLOBAL BEHAVIOR OF A CYLINDRICAL SALT DOME WITH A HLW REPOSITORY
J. Prij and J. Klok Dec. 1985 52 p
(ECN-180; B8660553; ESA-86-97736) Avail: NTIS HC A04/MF A01

The influence of the thermomechanical properties of the rock salt and the surrounding rocks on the thermal stresses and surface rise is discussed, based on finite element creep analyses of a homogeneous cylindrical salt dome. The parameters are constants in the thermomechanical constitutive behavior of salt and rocks and increase the thermal loading. It is shown that variations in the creep properties, which result in differences in creep strain rate of a factor 100, have only a very limited influence on the

thermal stresses and surface rise. More important is the elastic stiffness of the materials. In all creep analyses thermal stresses in the salt are compressive, and shear stresses reach values < 2 MPa. It is concluded that thermal stresses do not influence the isolation capability of homogeneous salt dome negatively. ESA

N86-32265# Interuniversitair Reactor Instituut, Delft (Netherlands).
[ACTIVITIES REPORT OF THE INTERUNIVERSITY REACTOR INSTITUTE] Annual Report, 1984 [INTERUNIVERSITAIR REACTOR INSTITUUT, JAARVERSLAG 1984]
1984 140 p In DUTCH
(ESA-86-97769) Avail: NTIS HC A07/MF A01

Radiation measurement and data processing, nuclear biomedical studies, and radioisotope applications are described. Radiochemistry excitation and ionization, charge migration in polymers and semiconductors, charge separation in excited molecules, radiation damage, and instrumentation were studied. Investigations in the fields of molecular physics, neutron depolarization, Mossbauer spectrometry, and instrumentation and software are summarized. Reactor physics statics, dynamics and noise of nuclear reactors, and radiation damage in materials were examined. ESA

74 OPTICS

Includes light phenomena.

N86-32266* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL DISTANCE MEASURING INSTRUMENT
James B. Abshire, inventor (to NASA) 15 Jul. 1986 10 p Filed 10 Aug. 1982 Supersedes N83-13982 (21 - 04, p 600)
(NASA-Case-GSC-12761-1; US-Patent-4,600,299; US-Patent-Appl-SN-406820; US-Patent-Class-356-5; US-Patent-Class-356-4.5) Avail: US Patent and Trademark Office CSCL 20F

An optical instrument, such as a stability monitor or a target range finder, uses an unstabilized laser to project a composite optical signal of coherent light having two naturally occurring longitudinal mode components. A beamsplitter divides the signal into a reference beam which is directed toward one photodetector and a transmitted beam which illuminates and is reflected from a distant target onto a second photodetector optically isolated from the first photodetector. Both photodetectors are operated on the square law principle to provide electrical signals modulated at a frequency equal to the separation between the frequencies of the two longitudinal mode components of the optical signal projected by the laser. Slight movement of the target may be detected and measured by electrically monitoring the phase difference between the two signals provided by the photodetectors and the range of the target measured with the aid of a microprocessor by changing the separation between the longitudinal modes by shifting the length of the resonator cavity in an iterative series of increments. Author

N86-32267 Fondazione Ugo Bordoni, Rome (Italy).
DIRECT MEASUREMENT OF THE NONLINEAR PHASE SHIFT BETWEEN THE ORTHOGONALLY POLARIZED STATES OF A SINGLE-MODE FIBER
Bruno Crosignani, Salvatore Piazzolla, Paolo Spano, and Paolo DiPorto Sep. 1984 5 p
(FUB-36-1984; ESA-86-97882) Copyright. Avail: Issuing Activity

The noise associated with the optical Kerr effect, which is a frequent cause of frequency broadening and pulse reshaping was studied. The light from a continuous wave linearly polarized argon laser was coupled to a polarization maintaining birefringent fiber. The excitation conditions are such as to provide single mode operation. The 2 polarization states have a power ratio of 25 to 1. The nonlinear effect is observed through the beat signal between the two orthogonal fields. The mathematical analysis shows that the model equation contains a nonlinear term following the time fluctuations of the polarization power in the first state. For a long fiber it can become relevant even at low power. The noise described is analogous to the phase noise generated in angle modulated fiber communication systems by power fluctuations of the source. ESA

N86-32268*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED ATTENUATION OF THALLIUM BROMO-IODIDE FIBERS
Beryl Magilavy (Informatics, Inc., Palo Alto, Calif.) and John Goebel Feb. 1986 27 p
(NASA-TM-86817; A-85370; NAS 1.15:86817) Avail: NTIS HC A03/MF A01 CSCL 20F

Analysis of attenuation measurements in the near infrared of an unclad fiber of Thallium Bromo-Iodide (Th(Br,I)), a polycrystalline thallium halide, is presented. A general overview is given of the properties of fiber optics. Two groups of attenuation measurements, for the region 1.2 to 3.4 and for 3 to 11 microns, respectively, are presented, analyzed, and compared with those of two other groups of researchers. Author

N86-32269*# Rhode Island Univ., Kingston. Dept. of Physics.
FIBER OPTIC PRESSURE SENSORS IN SKIN-FRICTION MEASUREMENTS Progress Report, 1 Oct. 1985 - 30 Jun. 1986
Frank W. Cuomo 4 Aug. 1986 10 p
(Grant NAG1-519)
(NASA-CR-176861; NAS 1.26:176861; PR-2) Avail: NTIS HC A02/MF A01 CSCL 20F

A fiber optic lever sensing technique that can be used to measure normal pressure as well as shear stresses is discussed. This method uses three unequal fibers combining small size and good sensitivity. Static measurements appear to confirm the theoretical models predicted by geometrical optics and dynamic tests performed at frequencies up to 10 kHz indicate a flat response within this frequency range. These sensors are intended for use in a low speed wind tunnel environment. Author

N86-32270# State Univ. of New York, Buffalo. Dept. of Chemistry.
LIGHT SCATTERING FROM A DEEP METALLIC GRATING Interim Technical Report
Dan Agassi and Thomas F. George Apr. 1986 12 p
(Contract N00014-86-K-0043)
(AD-A166319; UBUFFALO/DC/86/TR-7) Avail: NTIS HC A02/MF A01 CSCL 20/6

The conditions under which the Rayleigh hypothesis is exact and the convergence properties of the Rayleigh expansion are considered. The identification of the cause of the deficiency of this expansion suggests an alternative dressed expansion with presumably simpler convergence properties. This proposition is checked for a sinusoidal grating (SG), for which convergence is found for an arbitrary value of beta = (2pi) g/d, where g and d denote the height and periodicity of the SG, respectively. The dressed expansion is used to analyze the surface plasmon dispersion and local field enhancement distribution pertaining to the SG in the limit as beta goes to infinity. The dispersion relation is comprised of two bands. The local field enhancement predicts stronger fields at the bottoms of the troughs than at the peaks of the SG. GRA

N86-32271# Department of the Navy, Washington, D. C.
BROADBAND UNPOLARIZED LIGHT SOURCE Patent
William K. Burns and Robert P. Moeller, inventors (to Navy) Issued 3 Dec. 1985 5 p Supersedes AD-D010334
(AD-D012201; US-Patent-4,556,293; US-Patent-Appl-SN-490892; US-Patent-Class-350-400) Avail: NTIS US Patent and Trademark Office CSCL 20/6

Broadband, unpolarized light is produced by coupling a birefrigent optical fiber to a light emitting device, such as a superluminescent diode, which is capable of emitting broadband, partially polarized light. The optical fiber is made sufficiently long to provide an optical differential path length between its birefringent

axes which is longer than the coherence length of the light emitting device. GRA

N86-32272# Department of the Navy, Washington, D. C.
OPTICAL MATRIX-MATRIX MULTIPLIER BASED ON OUTER PRODUCT DECOMPOSITION Patent
William C. Collins, P. D. Stilwell, Jr., and Ravindra A. Athale, inventors (to Navy) Issued 4 Feb. 1986 7 p Supersedes AD-D010477
(AD-D012207; US-Patent-4,569,033; US-Patent-Appl-SN-504331; US-Patent-Class-364-845) Avail: US Patent and Trademark Office CSCL 20/6

An optical matrix multiplier using two linear modulating arrays in which the columns of the first matrix to be multiplied control the modulation of one array and the rows of the second matrix control the other array. Light is directed through all combinations of elements on the two arrays and the resultant beams measured by individual elements of a two-dimensional detector array. The detecting elements integrate the intensity of light falling on each of them, which value corresponds to an element of the product of the two matrices. The invention may be implemented among other ways with two linear electrooptical arrays, a linear array of light emitting diodes and a linear electrooptical array, or two Bragg cells and a pulsed light source. Author (GRA)

N86-32273# Army Night Vision Lab., Fort Belvoir, Va.
ON THE STABILITY OF THE PROBLEM OF TARGET TRACKING WITH THE FLIR Final Report, 1984 - 1985
David S. Anker Jan. 1986 5 p
(AD-A167721) Avail: NTIS HC A02/MF A01 CSCL 17/5

This document considers stochastic differential equations of Ito type. This problem is a fundamental one in the field of stochastic control. The theory of stochastic control has been successfully applied to a wide variety of practical problems as demonstrated in Maybeck, including problems involving the tracking of objects with imaging sensors. The problem of tracking aircraft with infrared sensors has been addressed in this mathematical framework by Kendrick, Maybeck, and Reid and by Maybeck, Jensen, and Harnley. The specific problem which gave impetus to this research involves real time control of the orientation of the optical axis of an infrared imaging sensor. The problem of choosing a good control for a system modeled in this framework involves the property of stability of solutions of the stochastic differential equation representing the system. Stability of these solutions is established by constructing a Liapunov function for the equation. In this way, the construction of a Liapuinov function for the equation is of great value in choosing controls. This and other background material are explained in Kushner. In his recent monograph, Mees remarked that there is no good general method for constructing Liapunov functions for systems represented by ordinary differential equations. GRA

N86-32274# Army Research Inst. of Environmental Medicine, Natick, Mass.
A PORTABLE SUBJECT CONTROLLED NIGHT VISION ADAPTOMETER
John L. Kobrick, Calvin Witt, and Jose Miletti Nov. 1985 15 p
(AD-A167848; USARIEM-T-1/86) Avail: NTIS HC A02/MF A01 CSCL 06/16

This report describes a new adaptometer which was designed at this Institute for assessing night vision parameters of the military population at field sites, and to quantify the effects of extended exposure to high altitude. The instrument is based on a previously developed concept of dark adaptation measurement in which the subject continually adjusts the threshold luminance of a recurrently flashing stimulus. This device, however, represents a modernized version of the technique which employs computerized data translation. It also offers the advantages of rugged construction and field portability. The instrument has functioned reliably in field conditions, and has generated valid dark adaptation functions on soldier test subjects in use at the USARIEM High Altitude Test Facility, Pikes Peak, Colorado. GRA

N86-32275# Office of Naval Research, London (England).
CURRENT GERMAN LASER AND QUANTUM OPTICS RESEARCH REVIEWED AT THE 50TH ANNUAL MEETING OF THE PHYSIKALISCHE GESELLSCHAFT
Paul Roman 23 Apr. 1986 9 p Meeting held at Heidelberg, West Germany, 17-21 Mar. 1986
(AD-A167895) Avail: NTIS HC A02/MF A01 CSCL 20/5

Advanced research at West German universities and research institutes in the general area of quantum optics was well represented at a large meeting in Heidelberg, March 1986. This report focuses on describing results in the areas of gas lasers, integrated optics, nonlinear processes, and novel solid-state lasers - with emphasis on the last. Author (GRA)

N86-32276# Georgia Inst. of Tech., Atlanta.
REAL TIME MATH MODEL FOR INFRARED Final Technical Report, Jun. 1983 - Sep. 1985
David R. Hertling and R. C. Rearick Jan. 1986 59 p
(Contract F30602-81-C-0185)
(AD-A168133; GIT/E4857A-85; RADC-TR-85-247) Avail: NTIS HC A04/MF A01 CSCL 17/5

The main objective of this work was to access the feasibility of developing a real time math model which could be used to process infrared imagery with current real-time stereo compilation equipment. A survey of existing infrared sensors, imaging sensors, photogrammetric techniques and procedures for stereo viewing and plotting are pesented. A flexible system model was developed which can be adapted to various types of infrared imaging systems. Investigations revealed that the photogrammetric techniques accurate enough for mapping and targeting applications require accurate flight dynamics data which must be simultaneously recorded with the imagery. It is theoretically possible to process certain images which contain known or analytically solvable ground information; however, such procedures would depend upon the image itself and would not be amenable to evolving into a generalized math model. GRA

N86-32277# Hughes Research Labs., Malibu, Calif. Optical Physics Dept.
OPTICAL CHARACTERIZATION OF NONLINEAR CRYSTALS
L. G. DeShazer and C. S. Hoefer Aug. 1985 18 p
(Contract W-7405-eng-48)
(DE86-006694; UCRL-15707-Pt-2) Avail: NTIS HC A02/MF A01

The final report on Optical Characterization of Nonlinear Crystals recorded the measurements of refractive indices and their thermal variations for thirteen nonlinear crystals isomorphic to KDP. This report is an Addendum to that report correcting some values reported for three crystals (AD*P, RD*P, KDA) and adding new data for three others (ADP, KDP, KD*P). The discrepancies in the final report resulted from crystals having either improper composition (AD*P) or wrong crystallographic orientation (RD*P, KDA). Six additional crystal prisms and slabs supplied by Interactive Radiation Inc. were used to obtain the corrected data reported here. Also, two crystals not measured before (RD*A, KDP:Rb) were measured and are described in this addendum. DOE

N86-32278# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
FIBER OPTIC MODIFICATION OF A DIODE ARRAY SPECTROPHOTOMETER
D. R. VanHare and W. S. Prather Jan. 1986 19 p
(Contract DE-AC09-76SR-00001)
(DE86-009572; DP-1714) Avail: NTIS HC A02/MF A01

Fiber optics were adapted to a Hewlett-Packard diode array spectrophotometer to permit the analysis of radioactive samples without risking contamination of the instrument. Instrument performance was not compromised by the fiber optics. The instrument is in routine use at the Savannah River Plant control laboratories. DOE

N86-32279# Stanford Univ., Calif.
MEASUREMENT TECHNIQUES USING ULTRASHORT OPTICAL PULSES Final Technical Report, 1 Oct. 1984 - 30 Sep. 1985

A. E. Siegman Feb. 1986 8 p
(Contract W-7405-eng-48)
(DE86-009691; UCRL-15792) Avail: NTIS HC A02/MF A01

The diffusion-driven detector uses gratings from crossed optical beams and diffusion to produce a very fast photodetector. Analysis of this instrument has been extended to the high level injection regime, indicating that the observed impulse response will be a single exponential rather than a double exponential. Also reported are laboratory renovations, in particular the installation of a cw mode-locked YAG laser and a sync-pumped dye laser. DOE

N86-32280# Los Alamos National Lab., N. Mex.
EXTREME ULTRAVIOLET MULTILAYER REFLECTORS
M. L. Scott, P. N. Arendt, B. J. Cameron, B. E. Newman, D. Windt, and W. Cash 1986 10 p Presented at the Topical Meeting on Short Wavelength Coherent Radiation, Monterey, Calif., 24 Mar. 1986 Prepared in cooperation with Colorado Univ., Boulder
(Contract W-7405-eng-36)
(DE86-010194; LA-UR-86-1378; CONF-860316-5) Avail: NTIS HC A02/MF A01

We have investigated the design, fabrication, and reflectance measurements of a multilayer silver/silicon reflector for use at 58.4 nm. Our results indicate that reflectors in the extreme ultraviolet do not perform as well as predicted due to the presence of surface oxides and other surface contamination layers. In addition, we have found that the correct optical constants for silver have now been published. We find also that these multilayer coatings can be utilized as reflective polarizers in the EUV with an extinction ratio of 75:1 and a throughput of 28% for the s-polarized component of the beam. DOE

N86-32281# Lawrence Livermore National Lab., Calif. Optical Sciences and Engineering Group.
FUNDAMENTALS OF THIN LENS OPTICAL SYSTEMS, LECTURES 1, 2 AND 3
L. Seppala Apr. 1986 69 p Presented at the Technology Series, Livermore, Calif., 1985
(Contract W-7405-eng-48)
(DE86-010642; UCID-20727) Avail: NTIS HC A04/MF A01

Viewgraphs are presented on the topics of: the physical properties of a thin lens - principal planes, focal points - and the imaging properties of a thin lens - object and image planes and magnification; the Y-Nu method for tracing paraxial rays through a thin lens optical system; and derivation of some of the fundamental relationships in a thin lens system. DOE

N86-32282# Institut National Polytechnique, Grenoble (France).
STUDY AND IMPLEMENTATION OF AN IMAGE SYNTHESIZER BASED ON A MODULAR ARCHITECTURE Ph.D. Thesis [ETUDE ET REALISATION D'UN SYNTHETISEUR D'IMAGES BASE SUR UNE ARCHITECTURE BANALISEE]
Victor Hugo ZarateSilva 1985 179 p In FRENCH Sponsored by Consejo Nacional de Ciencia y Technologia
(ESA-86-97295) Avail: NTIS HC A09/MF A01

Image synthesis operators adapted to a modules structure are studied. The goal is to allow for system reconfiguration depending on user requirements and application. Wired operators working in real time, such as image illumination computing or texture superposition are obtained. The system allows the simulation of four different light sources and the independent modeling of the reflection of each primary color on each object of the scene. ESA

N86-32283# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
SECOND GENERATION METEOSAT: INFRARED ATMOSPHERIC SOUNDER DESIGN
G. Chalon 4 Mar. 1985 22 p In FRENCH; ENGLISH summary
(CNES-T-85/CT/DRT/TIT/IO-046; ESA-86-97650) Avail: NTIS HC A02/MF A01

The design of optical remote sensors is discussed, including a system with gratings and a second with filters. In both cases the sensors use the available telescope. It is shown that the filtered sensor has a better performance and is to be preferred in spite of higher complexity. ESA

N86-32284# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
SECOND GENERATION METEOSAT IMAGER DESIGN
G. Chalon 11 Mar. 1985 29 p In FRENCH; ENGLISH summary
(CNES-T-85/052-DRT/TIT/IO; ESA-86-97651) Avail: NTIS HC A03/MF A01

An infrared imager for a spin stabilized Meteosat satellite is described. Infrared focal plane matrix arrays and long life mechanical coolers are required to satisfy the functional specifications. The performance of the different channels is discussed, showing that adopting a reasonable compromise only the night channel would remain below specifications. ESA

N86-32285# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kreiselgeraete und Traegheitsnavigation.
SETUP FOR THE DETERMINATION OF THE REFLECTIVITY OF INTERFERENCE COATINGS
Rolf Gauert and Joachim Bode Dec. 1985 25 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-85-18; ISSN-0176-7739; ESA-86-97590) Avail: NTIS HC A02/MF A01

A setup for measuring the reflectivity of evaporated interference coatings of laser mirrors is described. The coatings can be characterized by their reflectivity, which is determined by a compensation method. The setup is calibrated by a mirror of known reflectance. The system can determine the reflectivity with an accuracy of 0.1%. ESA

N86-32286# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
FIBER OPTIC SENSORS
Jan-Peter Bengtsson Mar. 1986 63 p In SWEDISH; ENGLISH summary
(FOA-C-30416-E1; ISSN-0347-3708; ESA-86-97862) Avail: NTIS HC A04/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR. 50

Fiber sensors are surveyed, and basic fiber theory is treated, as well as numerous sensor principles. These sensors can be made completely nonmetallic and without any electrical signals. Two acoustic sensor types are reviewed: the microbendsensor and the Mach-Lehnder interferometer. A fiber optical reflection sensor for acoustic detection is described; this device is not fully developed, technical problems appeared with the end diaphragm. ESA

N86-32287# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
STUDY OF OPTICAL COMPUTING
Vojin Plavsic Mar. 1986 43 p In SWEDISH; ENGLISH summary
(FOA-C-30418-E1; ISSN-0347-3708; ESA-86-97863) Avail: NTIS HC A03/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR. 50

The capabilities of optics to complement or replace electronics in the implementation of digital data processing is investigated. The inherent features of optics such as: multiple 2-D (parallel) broad band channels, higher switching speed, simplicity and flexibility in interconnection of arbitrary complex digital optical circuits, and power consumption are described. Practical results are rather modest; one explanation of this situation is the lack of clear architectural concepts for utilizing the benefits of optics. ESA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-32288 Institut d'Aeronomie Spatiale de Belgique, Brussels.
FRONTIERS OF THE PLASMASPHERE (THEORETICAL AS-

PECTS) Thesis
J. Lemaire 1985 283 p
(Aeronomica-Acta-A-298-1985; ESA-86-97483) Avail: Issuing Activity

The formation of the light ion trough, i.e., the depression of the ion densities H(+) and He(+), observed in the midlatitude ionosphere, is explained by two different mechanisms. The variations of the equatorial density of the total content and of the temperatures inside a plasma element are derived. The historical context within which experimental and theoretical understanding of the plasmasphere and of its equatorial limit the plasmapause developed since 1963 is described. ESA

N86-32289*# Alabama Univ., Huntsville. School of Science.
SPACE PLASMA RESEARCH Quarterly Progress Report, Apr. - Jun. 1986
Richard H. Comfort and James L. Horwitz Jul. 1986 14 p
(Contract NAS8-33982)
(NASA-CR-178898; NAS 1.26:178898) Avail: NTIS HC A02/MF A01 CSCL 20I

Temperature and density analysis in the Automated Analysis Program (for the global empirical model) were modified to use flow velocities produced by the flow velocity analysis. Revisions were started to construct an interactive version of the technique for temperature and density analysis used in the automated analysis program. A sutdy of ion and electron heating at high altitudes in the outer plasmasphere was initiated. Also the analysis of the electron gun experiments on SCATHA were extended to include eclipse operations in order to test a hypothesis that there are interactions between the 50 to 100 eV beam and spacecraft generated photoelectrons. The MASSCOMP software to be used in taking and displaying data in the two-ion plasma experiment was tested and is now working satisfactorily. Papers published during the report period are listed. B.G.

N86-32290# International Centre for Theoretical Physics, Trieste (Italy).
NON-LINEAR OPTICAL EXCITATION AND DETECTION OF THE PLASMON IN TWO-DIMENSIONAL ELECTRON GAS
Shi-Jie Gu Sep. 1984 8 p
(DE85-703230; IC-84/154) Avail: NTIS (US Sales Only) HC A02/MF A01

The theoretical calculation indicates that one can use the nonlinear difference-frequency mixing of two infrared beams to excite and detect the plasmon in the inversion layer without grating structure. The numerical estimation shows that the detection has enough sensitivity. DOE

N86-32291# Wisconsin Univ., Madison. Fusion Technology Inst.
ESTIMATES OF MAXIMUM TRAPPABLE ION BEAM POWER IN PLASMA CHANNELS
J. J. Watrous and R. E. Olson 1986 6 p Presented at the 7th Topical Meeting on the Technology of Fusion Energy, Reno, Nev., 15 Jun. 1986 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-006472; SAND-86-0283; CONF-860652-2) Avail: NTIS HC A02/MF A01

Conservation laws and solutions to the equations of motion for single particles have been used to obtained greatest lower bounds on the ion beam power that can be injected into and confined within plasma channels. These bounds are use in the evaluation of proposed light ion driven ICF experiments and reactor concepts. Simple estimates of trappable power based on conservation laws will be compared with estimates based on solutions to the equation of motion. Consequences of the results of these calculations to current design studies will be discussed. DOE

N86-32292# United Kingdom Atomic Energy Authority, Harwell (England). Instrumentation and Applied Physics Div.
PLASMA AND ION ETCHING FOR FAILURE ANALYSIS. PART 1: REVIEW OF CURRENT THEORY AND TECHNIQUES
M. Hardman, D. Mapper, J. Farren, and J. H. Stephen Paris ESA Jul. 1985 65 p
(Contract ESA-AO/5796/04-NL-AB)
(AERE-R-11907-Pt-1; HL85/1549-Pt-1; ESA-CR(P)-2177-Pt-1; ESA-86-97222) Avail: NTIS HC A04/MF A01

The state-of-the-art for the etching of semiconductor device materials, as applied to failure analysis, is reviewed. The basic mechanisms and techniques of dry etching were studied. Process parameters, such as rf power, gas mixture, pressure, and temperature and their effect on the etch process are reported. The Giga-Etch 100 E method of dry etching is recommended. Equipment available on the market is listed. ESA

N86-32293# Institut Franco-Allemand de Recherches, St. Louis (France).
STATIONARY, ONE-DIMENSIONAL MODELS FOR LASER-PRODUCED PLASMAS [STATIONAERE, EINDIMENSIONALE MODELLE FUER LASERERZEUGTE PLASMEN]
K. Daree 18 Jun. 1985 134 p In GERMAN
(ISL-R-107/85; ESA-86-97623) Avail: NTIS HC A07/MF A01

One-dimensional, stationary models for laser-produced plasmas were compared. The most interesting models seem to be those with the assumption of a self regulation of the plasma, i.e., based on the defined geometrical dimensions of the plasma. Such a model was numerically evaluated for a parallel flow, whereby the physical effects partial ionization, laser light absorption, and heat conduction were taken into account. The effect of several parameters (e.g., laser beam intensity, laser wavelength) on the calculation results is discussed. The calculation results agree very satisfactorily with experimental results. ESA

N86-32294# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
THE DEVELOPMENT OF A MAGNETOOPTIC CURRENT MEASUREMENT SYSTEM FOR HIGH, PULSED CURRENTS
H. S. Lassing Dec. 1985 49 p Sponsored by Euratom, Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek and Stichting voor de Technische Wetenschappen
(Rept-85-161; ESA-86-98045) Avail: NTIS HC A03/MF A01

A current-measurement system based on the Faraday rotation in a single-mode fiber for a screw pinch experiment is described. It is shown that an ultra low birefringence spun single-mode fiber is extremely suitable for use in a magneto-optic current-meter. The properties of this fiber were investigated. Measurements of high, pulsed currents (Imax = 1 MA: f = 25 kHz) with good accuracy and in accord with theory are presented. In order to calculate the current unambiguously and more accurately from the signals of the current-meter, a system with a double detector (to measure sin2 phi and cos2 phi simultaneously) was constructed. Measurements of high, pulsed currents with this system are also presented. It is concluded that a beam splitter prism is not the correct instrument for double detector measurements. A 50% transparant mirror and a double lens are suggested. ESA

N86-32295# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
ION TEMPERATURE IN TORTUR 3
F. B. Hendriks and H. J. B. M. Brocken Dec. 1985 36 p Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-85-162; ESA-86-98046) Avail: NTIS HC A03/MF A01

Spatially resolved ion-energy distributions for discharges in the TORTUR 3 tokamak are presented. The measurements were performed in an active method, using a neutral hydrogen probing beam of 20 to 30 keV, to enhance charge-exchange processes along its path, as well as by the usual passive method. Ion temperatures can amount to 1 keV. ESA

N86-32296# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
OPTIMIZATION STUDY FOR ION TEMPERATURE MEASUREMENTS BY MEANS OF RUTHERFORD SCATTERING
A. J. H. Donne and E. P. Barbian Mar. 1986 41 p Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-86-164; ESA-86-98047) Avail: NTIS HC A03/MF A01

A feasibility study to optimize the parameters when the Rutherford-scattering technique is applied to ion temperature measurement in a medium sized tokamak experiment was performed. Together with a time-of-flight analyzer with energy resolution of 100, a 20 keV helium probing beam with a neutral current density of 10 A/msq can provide a detailed spectrum within 3 msq, from which the ion temperature can be extracted with an accuracy of better than 10%. The influence of plasma impurities and resonant charge exchange on the scattering process is discussed. The good spatial resolution makes the method very suitable to investigate energy deposition profiles in ion-cyclotron radiation applied to the plasma for plasma heating. ESA

N86-32297# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
MODELS OF TWO QUEUES: A FEW NEW VIEWS
O. J. Boxma Jan. 1986 27 p Submitted for publication
(CWI-OS-R8603; B8664686; ESA-86-98051) Avail: NTIS HC A03/MF A01

Results for models of two queues, emphasizing mathematical analysis techniques are reviewed. Two classes of models are investigated: two parallel queues attended by a single server, and two queues in series. ESA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-32298 National Physical Lab., Teddington (England). Div. of Quantum Metrology.
PROPERTIES OF IMPURITY DOPED INFRARED PHOTOCONDUCTIVE DETECTORS UNDER CONDITIONS OF LOW BACKGROUND PHOTON FLUX
R. H. Bradsell Feb. 1986 14 p
(NPL-QU-76; ISSN-0309-3050; ESA-86-97264) Copyright. Avail: Issuing Activity

The performance of infrared impurity doped photoconductive detectors is evaluated under the conditions of low background photon flux encountered in space remote sensing applications. Detector cooling requirements; cryogenic preamplifiers; quantum efficiency; and photoconductive gain are discussed. ESA

N86-32299# Department of the Air Force, Washington, D.C.
SELECTIVE ANODIC OXIDATION OF SEMICONDUCTORS FOR PATTERN GENERATION Patent
Bijan Davari and Pankaj K. Das, inventors (to Air Force) Issued 11 Feb. 1986 11 p Supersedes AD-D011889
(AD-D012245; US-Patent-4,569,728; US-Patent-Appl-SN-667306; US-Patent-Class-204-15) Avail: US Patent and Trademark Office CSCL 20/12

The present invention relates to GaAs integrated circuit technology, and in particular, to a novel means of controlling oxidation growth rate on anodically oxidized GaAs samples. This abstract discloses an apparatus and a method for selectively controlling anodic oxide growth on semiconductors for controlled electrochemical pattern generation incorporating use of a writing beam of a wavelength which encourages oxide growth and a bias beam at a wavelength which discourages oxide growth. The bias beam is projected on the semiconductor in electrolytic environment to prevent or retard oxide growth while oxide growth is accelerated at points of illumination by means of writing beam. GRA

N86-32300# Auburn Univ., Ala.
SEMICONDUCTOR ALLOY THEORY Annual Report, 1 Sep. 1984 - 31 Aug. 1985
An-Ban Chen 27 Sep. 1985 58 p
(Grant AF-AFOSR-0282-84)
(AD-A166995; AFOSR-86-0159TR) Avail: NTIS HC A04/MF A01 CSCL 20/12

Investigated are many topics in the theory of semiconductors and alloys including (1) Generalized Brooks' formula and the electron mobility in SiGe Alloys, (2) bond-length distribution, lattice relaxation, bond energies and mixing enthalpies in alloys, (3) hardness and dislocation energy, (4) SiGe alloys band structures and core exciton binding energy and linewidth, (5) alloy statistics and microclustering and (6) sensitivity of deep levels to band structure and potential. The important results are outlined and the details are discussed in eight publications enclosed with the report. GRA

N86-32301# Cincinnati Univ., Ohio. Solid State Electronics Lab.
RAMAN SPECTROMETER WITH MICROPROBE CAPABILITY Final Report, 15 Jul. 1984 - 15 Jul. 1985
J. T. Boyd and H. E. Jackson 15 Jan. 1986 13 p
(Grant AF-AFOSR-0287-84)
(AD-A167008; AFOSR-86-0156TR) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report describes the results of this equipment grant funded as a part of the Department of Defense (DOD) University Research Instrumentation Program. This grant funded the purchase of a Raman spectrometer with microprobe capability having resolution of 1.0 micron. This report describes the equipment selecting decision, the configuration of the instrument selected, and some experimental results. The experimental results include Raman spectra used in characterization of laser recrystallized silicon and ion implanted regions in semi-insulating GaAs. The Raman microprobe can be used to characterize the effects of substrate temperature, beam power density and shape, beam scan speed and direction, deposition rate, substrate seeding, and polysilicon encapsulation schemes both near and away from grain boundaries. The frequency shift and the peak width of the Raman scattering from the triply degenerate zone center phonon in Si allow determination of the strain in the grains of laser recrystallized polysilicon. Reducing these strains will allow us to achieve large single grains of device quality. GRA

N86-32302# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN IMPROVED MODEL OF THIN FILM GROWTH M.S. Thesis
David J. Doryland Dec. 1985 133 p
(AD-A167147; AFIT/GEP/ENP/85D-2) Avail: NTIS HC A07/MF A01 CSCL 07/4

A VAX-11/785 computer was used to simulate the two dimensional growth of thin films produced by vapor deposition. In this model molecules and impurities were represented by three different sized disks. In order to simulate varying deposition conditions and evaporants, several variable parameters were introduced. Among these parameters were the variation of the deposition angle about some main angle, the mobility of the disks upon collision, the ability to introduce impurities into the microstructure, the simulation of multilayered coatings and the ability to introduce imperfections into the substrate. The results obtained by this model show that disks can be used to simulate some of the main features exhibited by vapor deposited films. Among these features are the formation of columns and their compliance with the tangent rule, and the disappearance of this structure in the case of large disk mobility. Another feature found to be exhibited in the modeled films is that under certain conditions impurities and substrate imperfections can produce large voids and/or nodules. Other characteristics found in the simulated films include pores which could allow water absorption, and increased packing

density for films produced with angle variations along with a moderate amount of disk mobility. GRA

N86-32303# Wales Univ. Inst. of Science and Technology, Cardiff.
OPTIMIZATION OF THE THERMOELECTRIC FIGURE OF MERIT OF FINE-GRAINED SEMICONDUCTOR MATERIALS BASED UPON LEAD TELLURIDE Final Technical Report, 31 Aug. 1984 - 30 Mar. 1986
D. M. Rowe Feb. 1986 41 p
(Contracts DAJA45-84-C-0029; DA Proj. 1T1-61102-BH-57)
(AD-A167647) Avail: NTIS HC A03/MF A01 CSCL 20/12

Lead telluride type semiconductors are used in the fabrication of thermoelectric modules. This report covers the programme to produce materials based upon lead telluride with improved figures of merit and hence greater thermoelectric conversion efficiency. One way of improving the figure of merit is by reducing the lattice thermal conductivity of the material. This can be achieved by increasing phonon grain boundary scattering. A realistic theoretical model has been developed for lead telluride and used to investigate the lattice thermal conductivity as a function of grain size and level of doping. In optimally doped material with a grain size of 1 micrometer, the reduction in lattice thermal conductivity was predicted to be 4-6 percent compared with equivalent single crystal. Thermal diffusivity measurements on small grained compacts supported this prediction. Phonon grain boundary scattering is enhanced in semiconductor alloys because of the presence of disorder scattering and the theoretical model was extended to take this factor into account. PbSnTe and PbGeTe were identified as alloys whose lattice thermal conductivity could be significantly decreased by a reduction in grain size and in optimally doped compacted material with a grain size of 0.5 micrometer the reduction compared to equivalent single crystal material was estimated to be 11 and 14 percent respectively. GRA

N86-32304# Eltron Research, Inc., Aurora, Ill.
CHARACTERIZATION OF ILLUMINATED SEMICONDUCTOR/SOLID-ELECTROLYTE JUNCTIONS. SEMICONDUCTOR REDOX POLYMER DETECTOR JUNCTIONS Interim Technical Report
Sharon K. Schmidt, Ronald L. Cook, and Anthony F. Sammells 15 Sep. 1985 25 p
(Contract N00014-84-C-0723)
(AD-A167665) Avail: NTIS HC A02/MF A01 CSCL 20/12

The dependency of n-TiO2 flatband potential (V sub fb) for cells of the general configuration: n-TiO2/Nafion 117, Redox species/SnO2 conducting glass, was systematically studied for the redox species Ru(bpy)32+, Fe(bpy)32+ and Ru(NH3)63+ as a function of their concentration within the polymer. The linear relationship V sub fb = M (1/concentration) + b, was found to hold for all cells. The slope (M) was found dependent upon metal complex used and its oxidation state. The sensitivity of n-TiO2, V sub fb to its immediate chemical environment at its interface with the redox polymer can be a strategy pursued for chemical detection. GRA

N86-32305# Eltron Research, Inc., Aurora, Ill.
SEMICONDUCTOR/SOLID ELECTROLYTE JUNCTIONS FOR OPTICAL INFORMATION STORAGE. ELECTROCHROMIC EFFECTS ON HEPTYL VIOLOGEN INCORPORATED WITHIN A SOLID POLYMER ELECTROLYTE CELL Interim Technical Report
Anthony F. Sammells and Nirupama U. Pujare 15 May 1986 17 p
(Contract N00014-84-C-0723)
(AD-A167666) Avail: NTIS HC A02/MF A01 CSCL 07/4

Solid state electrochromic cells of the configuration SnO2 Glass; poly(AMPS) + HV(2+) + NaPF6; Nafion 117; poly(AMPS) + CeC13 + NaPF6; SnO2 Glass were prepared. Upon subjecting the Heptyl Viologen (HV(2+)) working electrode compartment to a cathodic scan, two distinct reduction peaks were observed at respectively -1.74 and -1.90V versus the Cec13/SnO2 reference counter electrode. This corresponded to the formation of respectively, the radical and diradical cation species of HV(2+). This electrochromic cell was found to be highly electrochemically reversible as monitored by a He/Ne laser beam (583nm) transmitted through the bulk of this semitransparent thin film solid-state cell. Cells were also prepared using n-TiO2 as the working electrode in contact with the HV(2+) compartment. A progressive trend to more negative n-TiO2 flat band potentials (V sub FB) was observed between the initially prepared cell and the first and second electrochemically formed HV(2+) radical cation species. GRA

N86-32306# Cornell Univ., Ithaca, N.Y.
EXPERIMENTAL STUDY OF ELECTRONIC STATES AT METAL-DIELECTRIC INTERFACES Interim Technical Report, 2 Feb. 1983 - 31 May 1984
A. J. Sievers 23 Dec. 1985 16 p
(Grant AF-AFOSR-0121-81)
(AD-A167724; AFOSR-86-0075TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

The method of attenuated total reflection has been used in the visible region to obtain precise values of the dielectric function of Ag films in contact with different dielectric media. By measuring, at eight visible laser wavelengths, the surface-plasmon resonance of an Ag film against air and then against an organic liquid, we show that for both cases the dielectric function can be described by the Drude model with the well-known frequency-dependent relaxation time. The observed change in the frequency dependent parameters appears to eliminate all previous models which have been proposed to describe this frequency dependent relaxation time. The observed changes are consistent with the idea of a complex relaxation time whose real and imaginary parts are connected in a casual way. The index-of-refraction dependence of the Drude parameters demonstrates that surface electrodynamics must play an important role. Author (GRA)

N86-32307# Eltron Research, Inc., Aurora, Ill.
SEMICONDUCTOR/SOLID ELECTROLYTE JUNCTIONS FOR OPTICAL INFORMATION STORAGE. SOLID-STATE ELECTROCHROMIC CELL USING LUTECIUM DIPHTHALOCYANINE Interim Technical Report, 15 Sep. 1985 - 15 Jan. 1986
Anthony F. Sammells and Nirupama U. Pujare 15 Jan. 1986 13 p
(Contract N00014-84-C-0723)
(AD-A167869) Avail: NTIS HC A02/MF A01 CSCL 20/12

The overall program goal is to perform a basic investigation of photoelectrochemical and electrochemical effects by electrochromic materials in solid polymer electrolyte (SPE) containing solid-state cells. Initial investigations have been directed towards reversible electrochromic behavior at the interface between lutecium diphthalocyanine deposited onto electronically conducting glass, and the homopolymer poly-2-acrylamido -2-methylpropane sulfonic acid (poly(Amps)). We wish to report here some recent work on solid-state electrochromic cells in which ionic mediation to thin-film deposits of lutecium diphthalocyanine is via the homopolymer poly-2-acrylamido-2-methyl propane sulfonic acid (poly-Amps). Separation between the working (LuH(Pc)2 deposited onto SnO2 conducting glass) and counter (CeCl3 in poly (Amps)) electrodes in these solid-state cells was realized by the use of the insoluble copolymer perfluorosulfonic acid (Nafion). Solid-state electrochromic cells were prepared using the supporting electrolytes (SEs) 0.1M Na2SO4 and 0.1M KCl. Upon subjecting the cell to anodic and cathodic voltage scans, up to four distinct color changes were observed varying from red (at anodic potentials) to violet (at cathodic potentials). Formation of the violet lutecium diphthalocyanine reduction product was not found contingent upon the absence of alkali cations as reported by others. GRA

N86-32308# California Inst. of Tech., Pasadena. Dept. of Applied Physics.
OPTOELECTRONIC DEVICES AND RELATED PHYSICAL PHENOMENA IN THIN FILM SEMICONDUCTOR CONFIGURATIONS Final Report
C. Lindsey, J. Salzman, K. Vahala, and Amnon Yariv 1 May 1986 28 p
(Contract N00014-76-C-0322)
(AD-A167983) Avail: NTIS HC A03/MF A01 CSCL 20/12

A research program in semiconductor lasers and related phenomena resulted in new understanding relating to coherent single lobe laser arrays and to structures displaying near-diffraction-limited output. Using our molecular beam epitaxial reactor, we have demonstrated new unstable resonator geometry of semiconductor laser which potentially are capable of producing large aperture high power without the need for arrays. Typical powers of approx. 0.4 Watt were demonstrated in a single mode. Basic theoretical analysis and experiments on noise in semiconductor lasers has resulted in a new quantum formulation which takes into account the amplitude to phase coupling. This coupling is characterized by a new dispersive parameter alpha. Direct measurement of alpha were performed. GRA

N86-32309# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
SINGLE-CRYSTAL NEUTRON DIFFRACTION STUDY OF THE DISTRIBUTION AND THERMAL MOTION OF SILVER IONS IN ALPHA- AND BETA-Ag SI
J. J. Didisheim, R. K. McMullan, and B. J. Wuensch 1985 14 p Presented at the 5th International Conference on Solid-State Ionics, Lake Tahoe, Calif., 18 Aug. 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contract DE-AC02-76CH-00016)
(DE86-005056; BNL-37301; CONF-850870-5) Avail: NTIS HC A02/MF A01

Single-crystal neutron diffraction data have been used to examine the distribution of mobile Ag ions in anion-ordered -Ag Si (space group Pm3m) and anion-disordered -Ag Si (space group Im3m) at 8 temperatures in the overall range 23 to 475 C. The Ag density in the phase is confined to a cluster of four tetrahedral sites grouped at the centers of the cell faces, closely spaced as a result of the different distances between Ag and the two species of anion. The individual sites are not resolved in Fourier syntheses because of large thermal displacements within a flat potential well, but the refinements permit rejection of occupancy of the octahedral site. The Ag distribution in -Ag Si displays a 2-coordinated site on the body diagonal of the cell and density delocalized in (100) bands which display fine structure not present in -AgI or -AgS. This feature may be qualitatively interpreted as an average over positional disorder of the equilibrium position within the tetrahedral interstice, the location depending on the short-range configuration of anions about the site. Models employing partial Ag occupancy of the 2-coordinated position plus either octahedral or tetrahedral site occupancy involve the same number of structural parameters and refined to comparable levels. Tetrahedral site occupancy is judged to be somewhat more likely on the basis of agreement for the higher temperature data sets and physical criteria. DOE

N86-32310# Oak Ridge National Lab., Tenn.
MICROCRYSTALLINE GROWTH STUDIES IN MODEL OXIDE BY DYNAMIC LASER-LIGHT SCATTERING METHODS
C. H. Byers and M. T. Harris 1986 6 p Presented at the 4th Contractors' Workshop on Advanced Laser Technology for Chemical Measurements, Seattle, Wash., 29 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-007300; CONF-8604130-1) Avail: NTIS HC A02/MF A01

A state-of-the-art laser light scattering facility has been developed for determining the average size of a seed material. The homogeneous nucleation technique has been used to study tetraethoxy orthosilane (TEOS), which hydrolyzes to produce silica. The titanium analog of TEOS is also being studied. DOE

N86-32311# Allied-Signal, Inc., Morristown, N.J. Electronic Materials and Devices Lab.
UNIFORMLY-DOPED Cr, Nd:GGG CRYSTALS Final Report, 1 Jan. 1985 - 31 Dec. 1985
E. W. ODell 11 Apr. 1986 21 p
(Contract W-7405-eng-48)
(DE86-009692; UCRL-15784) Avail: NTIS HC A02/MF A01

It has been demonstrated that the pellet feed technique can achieve leveling of chromium concentration in Czochralski growth of Cr, Nd:GGG crystals, but there are serious problems. The most serious one is the presence of iridium inclusions from using the leveling technique. It would be best to attack the problem by preheating the feed material. Observed local variations in refractive index are attributed to variation in chromium concentration. Stress birefringence has varied somewhat in degree and distribution from run to run, but has generally been rather strong in spite of the use of extended necking before starting the cone, efforts to achieve smooth control, etc. DOE

N86-32312# North Carolina Univ., Chapel Hill. Dept. of Physics and Astronomy.
ION BEAM CHANNELING IN SUPERLATTICES
W. K. Chu, W. R. Allen, S. T. Picraux, and J. A. Ellison 1986 5 p Presented at the Materials Research Society Spring Meeting, Palo Alto, Calif., 15 Apr. 1986 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex. and New Mexico Univ., Albuquerque
(Contract DE-AC04-76DP-00789)
(DE86-010094; SAND-85-2388C; CONF-860445-9) Avail: NTIS HC A02/MF A01

Ion beam channeling analysis has recently been applied to lattice strain measurements on strained-layer superlattices (SLS). In this review talk, we outline three different methods of strain measurement: axial dechanneling, angular scans, and planar resonance. We describe the principles and illustrate them with examples; we also give a detailed theoretical treatment of the planar resonance effect in SLS's. DOE

N86-32313# Fraunhofer-Inst. fuer Solare Energiesysteme, Freiburg (West Germany).
DEPOSITION OF CRYSTALLINE SEMICONDUCTOR LAYERS ON AMORPHOUS SUBSTRATES (GRAPHOEPITAXY) Final Report, Jun. 1984
Armin Raeuber and Helmut Hirth Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 66 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-160; ISSN-0340-7608; ESA-86-97441) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14

Oriented monocrystalline GaAs layers were prepared on insulating substrates. Oxidized silicon wafers served as substrates because of their excellent surface quality and the possibility of developing Si/SiO2/GaAs sandwich structures. The GaAs was deposited by chemical vapor deposition techniques. Nucleation and overgrowth experiments were performed using etched or deposited structures with dimensions of a few microns as nucleation activators. The selectivity of nucleation is very high, surfaces without activation staying completely free of deposition. Nucleated crystals are in many cases uniform in orientation but not in diameter. Overgrowth experiments were successful when growth was started on a GaAs substrate but were difficult with nucleated crystals. ESA

N86-32314# Technische Univ., Berlin (West Germany). Inst. fuer Werkstoffe der Elektrotechnik.
DEVELOPMENT OF MODELS FOR THE SIMULATION OF THE TEMPERATURE BEHAVIOR OF MOSFETS IN ANALOG AND DIGITAL CIRCUITS IN THE TEMPERATURE RANGE BETWEEN MINUS 55 DEG C TO PLUS 150 DEG C Final Report, Jul. 1984
Juergen Koettnitz, Wolfgang Krautschneider, and Hans-Guenther Wagemann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 101 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-167; ISSN-0340-7608; ESA-86-97445) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21.50

The semiconductor fundamentals responsible for the temperature behavior of MOS transistors (intrinsic density, carrier mobility, interface state charge, oxide charge, difference of work functions)

were investigated and used for the development of simulation models. Methods to extract model parameters from measured characteristics (e.g., threshold voltage, inversion layer mobility, mobility reduction factor, parasitic series resistance, electrical length of the channel) are presented. Parameters obtained with a physical approach supply indications for further improvement of the models and provide a quality control for the semiconductor technology. ESA

N86-32315# Stuttgart Univ. (West Germany). Inst. fuer Netzwerk- und Systemtheorie.
DEVELOPMENT OF HUMIDITY SENSORS IN TANTALUM THIN FILM TECHNOLOGY Final Report, Dec. 1983
Christian Borgwardt, Traugott Kallfass, and Ernest Lueder Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 129 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-175; ISSN-0340-7608; ESA-86-97447) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27

Dielectric humidity sensors using tantalum thin film technology were manufactured. Tantalum oxide, formed by anodization of sputtered, M-doped, low density tantalum, was used as a porous dielectric layer sensitive to humidity. Among different structures investigated for the electrodes, the best performance was achieved by comb-like, selfaligned electrodes. Capacitance of the dry sensor is between 700 and 1000 pF, tangent of the loss angle at 1 kHz between 10% and 30%; sensitivity 0.5% to 1.5% per % relative humidity (RH) at 50 c and 1kHz; temperature coefficient 5%o/K (temperature between 10 and 50 C, RH 50%, 1 kHz); time characteristics for a change in humidity from 5% to 90% at 20 C are time constant i.e., less than 10 sec, rise time 90% about 45 sec. Simple measuring circuits were developed for the evaluation of the sensor signals. The comb-like sensor was integrated in a thin film hybrid circuit. ESA

N86-32316# Consortium fuer Elektrochemische Industrie G.m.b.H., Munich (West Germany).
THE BEHAVIOR OF NONROTATIONAL STRIATIONS IN SILICON Final Report, Dec. 1981
Helmut Koehler Bonn, West Germany BMFT Dec. 1985 44 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-014; ISSN-0170-1339; ESA-86-97458) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.50

Striations in silicon were studied to determine the effects of gravity and the gradients of surface strain (Marangoni effect). Crystallization of silicon melts in quartz and borum nitride containers of Si melting drops with free surface were studied under gravity and weightlessness. Under destabilizing temperature gradients, nonrotational striations are observed and can be correlated to cellular convection theory. The transition from striated to homogeneous material is described by the critical Rayleigh number. Silicon melts with free surface (molten tip of Si rod) show extended striations due to time-dependent surface driven flow (Marangoni effect). In a Spacelab experiment a molten silicon drop with a free surface slowly crystallized under zero gravity confirms the existence of the Marangoni effect under weightlessness. ESA

N86-32317# Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Lage Temperaturen.
MAGNETIC PROPERTIES IN THE PARAMAGNETIC AREA OF TWO FERROMAGNETIC SUPERCONDUCTORS Ph.D. Thesis [MAGNETISCHE EIGENSCHAPPEN, IN HET PARAMAGNETISCHE GEBIED, VAN TWEE FERROMAGNETISCHE SUPERGELEIDERS]
Armand Pruijmboom May 1984 77 p In DUTCH
(ESA-86-97377) Avail: NTIS HC A05/MF A01

Susceptibility measurements in the temperature range 1.5 to 4.2 K were carried out on an Ho1,2Mo6S8 preparation and ErRh1,1Sn3,6 monocrystals using a SQUID and a 10T (i.e., a 0 to 10 Telsa magnetic field variability) susceptometer. A reliable value for the Curie-constant was found while calibrating the 10T disposition. Measurements at H=0 field strength yield an effective ground state moment of 10.16 muB/atom and a 0.11 K paramagnetic Weiss temperature dependance of the Curie-constant which corresponds to the existence of a still lower situated doublet with smaller effective moment is found. A model for the exchange of energy between the spin system, and the conduction electron system and the grid system (in which the conduction electrons exchange energy with the liquid He via the grid) was developed to explain the behavior of the relaxation time above lambda temperature. ESA

N86-32318# Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Lage Temperaturen.
INVESTIGATION OF THREE FERROMAGNETIC SUPERCONDUCTORS IN THE MILLI-KELVIN AREA Ph.D. Thesis [ONDERZOEK AAN DRIE FERROMAGNETISCHE SUPERGELEIDERS IN HET MILLIKELVINGEBIED]
Eric Gerritsen May 1984 98 p In DUTCH
(ESA-86-97380) Avail: NTIS HC A05/MF A01

The ternary bonds Ho12Mo6S8 (1), ErRh4Sn3,6 (2), and ErRh4B4 (3), were prepared and investigated, using a 3He-4He mix-cooling machine to create a 100 mK temperature area in which superconductivity and ferromagnetic order can coexist. Direct Current Magnetization (DCMM's) and Resistance Measurements (RM's), were carried out using a SQUID. Crystals of (2) were prepared from Er:Rh melt ratios of 1:1 (a), and 1:2 (b). The DCMM's show ferromagnetic order at temperatures Tc2 of 0,75 K, and 0.52 K. The RM's show superconductivity for only a small part of the (a)-crystals at a temperature Tc1=0.5 K, but a complete superconductivity for the (b)-crystals at Tc1=1.07 K. Temperatures for which the crystals become normal again are 0.66 K (a), and 0.38 K (RM) and 0.52 K (DCMM) for (b). A method to reduce magnetization changes to absolute values for susceptibility was determined. For preparation (3) a Tc1=8.7 K is found. ESA

N86-32319# Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Lage Temperaturen.
DYNAMIC SUSCEPTIBILITY ON TWO FIRST-ORDER PHASE TRANSFORMATIONS Ph.D. Thesis [DE DYNAMISCHE SUSCEPTIBILITEIT OP TWEE EERSTE ORDE FASE OVERGANGEN]
J. L. Top May 1984 100 p In DUTCH
(ESA-86-97381) Avail: NTIS HC A05/MF A01

The differential susceptibility of monocrystals in liquid He was measured at 1.64 to 4.2 K with varying magnetic background, magnetic frequency, and the angle in one crystal plane. Anisotropy and critical field strength of the spinflop system CsMnBr3.2H2O were determined as a function of temperature. Assuming a dependence of the activating energy upon the strong coupling in the chains, the relaxation time of the phase transformation was measured (which confirmed the nucleation theory). The axis of preferance in the ac-plane of the metamagnet RbCoCl3.2H2O was unequivocally determined. The angle dependent susceptibility in the phase transformation was explained by the strong anisotropy of the system. The demagnetization factor of an almost ideal spherule was obtained by grinding a crystal. The domain wall relaxation in the phase transformation as a function of the field was investigated. The relaxation time appears minimal in the middle of the transformation and increases when one phase prevails. ESA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-32320# California Univ., Los Angeles. Dept. of Physics.
THEORIES AT 10 SUP (-17) AND 10 SUP (-33) cm

I. Bars 1985 17 p
(Contract DE-FG03-84ER-40168)
(DE86-006870; DOE/ER-40168/T1) Avail: NTIS HC A02/MF A01

Rapid progress is reported in the areas of Superstring Theory, Composite Quarks and Leptons, Supergravity and Kaluza-Klein Theories. We have shifted our interest heavily toward the Superstring Theory since it has become the most promising unified theory for solving the fundamental questions in the standard model as well as quantum gravity. DOE

N86-32321# International Centre for Theoretical Physics, Trieste (Italy).
SOME FEATURES OF SUSY BREAKING IN N=2 SUPERGRAVITY
S. Cecotti, L. Giradello, and M. Porrati Aug. 1984 11 p
(DE85-703198; IC-84/115) Avail: NTIS (US Sales Only) HC A02/MF A01

We discuss some features of SUSY breaking in N=2 supergravity. Firstly, we show that in a general N=2 Sugra model (constructed according to the tensor calculus) all stationary points of the potential, at (LAMBDA)=0, are fully supersymmetric if the compensating multiplet is not gauged. Thus a viable super-Higgs effect in N=2 supergravity can occur only in the presence of a Fayet-Iliopoulos term. Then we present an explicit model with two scales of breaking in anti-de Sitter space. Moreover, the ratio of the two gravitino masses is sliding i.e., not determined by the classical potential. In the extreme situation one of the gravitino mass equals (RADICAL)-(LAMBDA)/3, and thus we have partial super-Higgs (in AdS space). The cosmological constant may be arranged to an arbitrary small value while keeping the mass of the heavy gravitino constant. DOE

N86-32322# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
SCHEME TO UNIFY GRAVITY AND ELECTRO-WEAK INTERACTIONS
M. Novello and H. Heintzmann 1985 20 p Prepared in cooperation with Cologne Univ., West Germany
(DE86-701921; CBPF-NF-058/85) Avail: NTIS (US Sales Only) HC A02/MF A01

The theory of electro-weak interactions and Jordan's description of Einstein's Theory of gravity are unified in a unique scheme. A short-range counterpart of gravity, involving massive tensor bosons of masses 365 GeV and 520.3 GeV, is obtained within the new scheme. DOE

N86-32323# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-H.
STRUCTURE OF SUPERSYMMETRIC THEORIES
J. W. vanHolten Mar. 1986 14 p Presented at Second Hellenic School on Elementary Particle Physics Conference, Corfu, Greece, Sep. 1985
(NIKHEF-H/86-8; B8665343; ESA-86-98059) Avail: NTIS HC A02/MF A01

The classical structure of globally supersymmetric field theories is introduced. The geometrical interpretation in terms of Kahler manifolds is reviewed. Internal symmetries and their gauging are described. Elementary aspects of quantum supersymmetry and their effects on the particle spectrum are explained. ESA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-32324# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CALENDAR OF SELECTED AERONAUTICAL AND SPACE MEETINGS
Jul. 1986 142 p In FRENCH and ENGLISH
(AGARD-CAL-86/1; ISBN92-835-0398-8) Avail: NTIS HC A07/MF A01

Three kinds of events are covered by this calendar: technical meetings, conferences, and symposia, held in all parts of the world, in the field of Aerospace Research and Development as well as in other directly related scientific fields, such as energy, geophysics, and acoustics; exhibitions and technical displays covering the same fields of interest; and educational courses, short or long, given by certain specialized institutions. For each meeting, exhibition, or course, the following information is given: reference number, date, location, title and sponsor, keywords indicating main topics covered; and contact code for inquiries. A subject index in the form of keywords is given. B.G.

N86-32325# Maryland Univ., College Park. Center for Productivity and Quality of Working Life.
METHODOLOGY FOR GENERATING EFFICIENCY AND EFFECTIVENESS MEASURES (MGEEM): A GUIDE FOR COMMANDERS, MANAGERS AND SUPERVISORS Final Report, 1 Jul. 1984 - 31 Jan. 1986
Thomas C. Tuttle and Charles N. Weaver May 1986 28 p
(Contract F33615-83-C-0030)
(AD-A167503; AFHRL-TP-86-26) Avail: NTIS HC A03/MF A01 CSCL 05/1

MGEEM is a multi-step procedure which permits the creation in any organization of a complete productivity measurement system. It provides an overview of the MGEEM process and identifies anticipated benefits, costs, and risks for the Air Force commander, manager, or supervisor contemplating its use. The companion TP, Implementing MGEEM: A Manual for Air Force Measurement Facilitators, provides sufficient technical detail to guide a measurement facilitator through the operational use of the procedure. In a target organization, the MGEEM process begins when a measurement facilitator uses a structured group technique to bring about consensus among the commander (manager or supervisor) and his/her immediate subordinates concerning the organization's principal intended accomplishments, called Key Result Areas (KRAs). In the second step, the facilitator again uses a structured group technique to bring about consensus among another group, the commander's immediate subordinates and selected members of their immediate subordinates, on the question of what the commander needs to know how well the organization is doing on each KRA. GRA

N86-32326# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE DEFENSE SPACECRAFT MARKET M.S. Thesis
Brad S. Bigelow Dec. 1985 174 p
(AD-A167602; AFIT/GSO/ENS/85D-2) Avail: NTIS HC A08/MF A01 CSCL 05/3

This study examines the defense spacecraft market in the context of the classical industrial organization paradigm. It takes as the basis for its evaluation of the market the concept of effective competition, using the criteria proposed by Stephen Sosnick in his article, Toward a Concrete Concept of Effective Competition. The thesis begins by briefly describing the origin and evolution of the military space program. It then addresses the structure of the market, outlining the composition and concentration of the industry, the nature of the product, the extent of demand, and the conditions of supply. It discusses the particular structural features of the Department of Defense market. It shows how the conduct of the

market is predominantly influenced by the DOD acquisition process for space systems. The examination of market performance focuses on internal and allocative efficiency, revealing a dramatic decline in productivity since the mid-1960s, due in large part to the increase in the unit cost of materials. It concludes by highlighting the links between the structure, conduct, and performance and shows how deviations for effective competition in the market result from these interactions. GRA

N86-32327# Air Force Systems Command, Bolling AFB, Washington, D.C.
GUIDE TO CANADIAN AEROSPACE RELATED INDUSTRIES
Donald J. Pearson and John R. Niles 28 Feb. 1986 131 p
(AD-A167794; AFSC-TR-86-001) Avail: NTIS HC A07/MF A01 CSCL 05/3

Ths guide is a contracting source list of Canadian aerospace related industries to be used by USAF procurement offices, program manageres, project engineers, and scientists. It provides company profiles, a company keyword index, and contact points for each company. GRA

N86-32328# Technische Hogeschool, Einhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
PRODUCTION AND INVENTORY CONTROL WITH THE BASE STOCK SYSTEM
J. P. J. Timmer, W. Monhemius, and J. W. M. Bertrand May 1984 39 p
(EUT/BDK/12; ISBN-90-6757-012-5; ESA-86-97686) Avail: NTIS HC A03/MF A01

Base stock control (BSC), of safety stocks in a multiproduct multiphase production system is compared with techniques such as master product scheduling. It is shown that BSC results in good control with a low level of safety stocks and reduced control effort. ESA

N86-32329# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
BALANCING PRODUCTION LEVEL VARIATIONS AND INVENTORY VARIATIONS IN COMPLEX PRODUCTION SYSTEMS
J. W. M. Bertrand Apr. 1984 18 p
(THE/BDK/84; ESA-86-97688) Avail: NTIS HC A02/MF A01

The behavior of production levels and stocks in an integrally controlled multiproduct multiphase production system is analyzed. It is shown that certain types of variations in the master production schedule (MPS) may lead to large short term variations in production. To reduce the costs of these variations production smoothing is introduced; a modification of well-known integral production decision rules is derived to realize smoothed production behavior. The quantitative effects of the production smoothing rule on the variations in stocks and production levels are demonstrated. A cost model to determine appropriate values for the smoothing parameters, given a specific production structure, a given capacity structure, and a given variability of the MPS is outlined. ESA

N86-32330# Technische Hogeschool, Eindhoven (Netherlands).
CALCULATING WORKLOAD NORMS FOR JOB SHOPS
J. W. M. Bertrand Apr. 1984 5 p
(BDK/KBS/84-04; ESA-86-97689) Avail: NTIS HC A02/MF A01

A job scheduling and due date assignment rule that adapts the flow time allowance per operation to the time-aggregated remaining workload per work center is described. The method is valid for jobs requiring a linear sequence of operations as well as for single and multilevel assembly types of jobs. Flow time allowances are based on the remaining workload for the work center where the operation is to be performed. To determine an initial schedule, each operation of a job is given an operation due date, which is equal to the maximum operation due date of the previous operation(s), plus the flow time allowance. ESA

N86-32331# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
THE TRADE-OFF MODULE: AN AID TO BALANCE LOGISTICAL-LY RELATED COSTS [DE TRADE - OFF - MODULE: EEN HULPMIDDEL BIJ HET BALANCEREN VAN LOGISTIEK GERELATEERDE KOSTEN]
P. Durlinger Dec. 1984 20 p In DUTCH
(BDK/KBS/84-06; ESA-86-97690) Avail: NTIS HC A02/MF A01

A model, called the Trade-off Module (TOM), was developed in order to assist in the balancing of the costs between the different divisions in an industry. The model calculates the logistic and economic consequences of decisions concerning delivery times, delivery reliability, size of production series, and production packages. The TOM can be applied on assembly line level. A production unit model, simplified to such an extent that big mistakes on a lower level are excluded, is described. The position of the TOM within the decision hierarchy is outlined. The gray box method used for the application of the TOM in practice is explained. The passage time in a production unit was calculated. The dual constraint (man and machine) problem is explained. ESA

N86-32332# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
THE STRUCTURING OF PRODUCTION CONTROL SYSTEMS
J. W. M. Bertrand and J. Wijngaard May 1984 46 p
(THE/BDK/ORS/84/10; ESA-86-97691) Avail: NTIS HC A03/MF A01

A qualitative methodology for designing hierarchically structured production control systems for complex production situations is presented. The methodology is based on the assumption that complexity should be reduced by defining self-contained subsystems with clear and well-defined operational characteristics. Interactions between the subsystems should be simple and restricted. The production unit (PU) is introduced as a basic control entity. From the perspective of goods flow control the PU's are black boxes having certain operational characteristics. The objective of goods flow control is to realize a delivery performance, taking into account the PU-operational constraints. The main elements in the goods flow control structure developed are master planning, material coordination, workload control and work order release. ESA

N86-32333# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
DUE-DATE RELIABILITY IN A REPAIR SHOP: IMPLICATIONS FOR ORGANIZATIONAL AND WORK DESIGN
H. Kuipers, P. Reinking, and J. C. Wortmann Jul. 1984 29 p
(THE/BDK/KBS/84-14; ESA-86-97692) Avail: NTIS HC A03/MF A01

The design and introduction of a work-order control system in a repair shop to increase the shop's due-date reliability under conditions of uncertainty are discussed. The consequences of the control system for organizational structure and work design are illustrated. The system has far reaching implications for the responsibilities and tasks of employees at each level. Organizational changes, based on notions of the contingency approach are described. Task-design and group-design theory is used to analyze the task-content implications. ESA

N86-32334# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
STRUCTURING THE PRODUCTION CONTROL PROBLEM IN A REPAIR SHOP
J. C. Wortmann and K. Tol Aug. 1984 9 p
(THE/BDK/KBS/84-16; ESA-86-97693) Avail: NTIS HC A02/MF A01

The production control system in a repair shop was improved by structuring the control problem, i.e., decomposing the problem into a number of weakly interdependent subproblems. The proposed control structure distinguishes a master planning level, that sets due-dates for major phases of a repair order; a materials coordination level, that coordinates suborders; and a departmental control level to deal with suborders. A decomposition of the information system into a master planning system and a detailed planning system follow from the control structure. ESA

N86-32335# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
A COMPARISON OF CAPACITY ORIENTED AND PRODUCT ORIENTED APPROACHES TO GOODS FLOW CONTROL
Roland Bemelmans and Jacob Wijngaard Apr. 1984 20 p
(ARW-03-THE-BDK/ORS/84/11; ESA-86-97700) Avail: NTIS HC A02/MF A01

The product oriented and the capacity oriented approaches to goods flow control in a multiproduct multistage make-to-stock situation are compared. No clear superiority of either approach is revealed, but the capacity oriented approach makes the relationship to higher levels of control easier. It is possible to combine capacity adjustment decisions with capacity usage decisions. The product oriented approach needs a separate (aggregate) model to make the capacity adjustment decision and it is not always easy to couple this level of decision making properly to the (detailed) product oriented approach of the goods flow control level. ESA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-32336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BIBLIOGRAPHY OF LEWIS RESEARCH CENTER TECHNICAL PUBLICATIONS ANNOUNCED IN 1985
May 1986 307 p
(NASA-TM-87263; E-2960; NAS 1.15:87263) Avail: NTIS HC A14/MF A01 CSCL 05B

This compilation of abstracts describes and indexes the technical reporting that resulted from the scientific and engineering work performed and managed by the Lewis Research Center in 1985. All the publications were announced in the 1985 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace Abstracts). Included are research reports, journal articles, conference presentations, patents and patent applications, and theses. Author

N86-32337# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
UNCLASSIFIED PUBLICATIONS OF LINCOLN LABORATORY. VOLUME 2: REPORT BIBLIOGRAPHY Report, 31 Dec. 1984 - 31 Dec. 1985
31 Dec. 1985 61 p
(Contract F19628-85-C-0002)
(AD-A167987; ESD-TR-85-320-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/5

This bibliography lists reports published from 31 December 1984 to 31 December 1985, as well as updated information on earlier publications. Author and subject index are provided as well as DTIC AD-number when available. GRA

N86-32338# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DATABASE CAPACITY PLANNING AND MANAGEMENT
K. Linsenmann 1986 24 p Presented at the 15th International Software AG Users Conference, San Diego, Calif., 11 May 1986
(Contract DE-AC07-76ID-01570)
(DE86-009076; EGG-M-03286; CONF-860593-1) Avail: NTIS HC A02/MF A01

The DATABASE ADMINISTRATION (DBA) has developed a utility process that performs three functions utilizing the ADABAS general control block (GCB) and the ADABAS file control block (FCB). The three functions are file space management, automated file unload/load and physical file placement and management. ADABAS cost per command, ADABAS command durations and labor cost have been examined. DOE

N86-32339# Oak Ridge National Lab., Tenn.
CARBON DIOXIDE INFORMATION CENTER THESAURUS
R. E. Millemann and R. M. Cushman Apr. 1986 62 p
(Contract DE-AC05-84OR-21400)
(DE86-009013; ORNL/CDIC-5) Avail: NTIS HC A04/MF A01

This thesaurus lists the keywords (including narrower, broader, and related terms, as well as forbidden terms) used by the Carbon Dioxide Information Center for the input and retrieval of records for its Bibliographic Information System (BIS). BIS is a specialized bibliographic data base on carbon dioxide and climate. It is being merged into the Department of Energy's Energy Data Base (EDB). The keywords used in the BIS Thesaurus are also used in the much larger EDB thesaurus so EDB may be searched for CO2 records. DOE

N86-32340# Argonne National Lab., Ill.
COMPUTING SERVICES SOFTWARE LIBRARY
L. M. Clark and W. H. Jones Mar. 1986 52 p
(Contract W-31-109-eng-38)
(DE86-009491; ANL/TM-436) Avail: NTIS HC A04/MF A01

This technical memorandum serves as a practical guide for managers, supervisors, programmers, analysts, and other data processing personnel who need to consult the documentation or use the software available in the Software Library. Policies and procedures necessary to preserve the software documentation and protect the Laboratory's investment in software are presented. Included are sections on responsibilities of the Software Librarian and Software Coordinators, software change control policy, systems programming section software maintenance tools, information systems section software maintenance tools and use of the LIBRARY exec. The LIBRARY exec, which serves as the Master Index, provides on-line information about documents. DOE

N86-32341# Research Inst. of National Defence, Linkoeping (Sweden). Lab. for Information Systems.
[ACTIVITIES REPORT OF THE LABORATORY FOR INFORMATION SYSTEMS] Annual Report, 1985
Jan. 1986 50 p
(FOA-C-30410-E1; ISSN-0347-3708; ESA-86-97239) Avail: NTIS HC A03/MF A01; Research Inst. of National Defense, Stockholm, Sweden KR 50

Research activities concerning computer vision; a geographical information system; knowledge engineering; space information systems; and computer techniques are summarized. Associated activities include image processing, mathematical software in Ada, and instrumentation and data acquisition. ESA

N86-32342# Institut National Polytechnique, Grenoble (France).
COHERENCE MAINTENANCE IN DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis [MAINTIEN DE LA COHERENCE DANS LES SYSTEMES D'INFORMATION REPARTIS]
Roland Balter 1985 186 p In FRENCH
(ESA-86-97292) Avail: NTIS HC A09/MF A01

Coherence control in distributed systems is studied. The coherence, transaction and atomization concepts are discussed. The properties of coherence control mechanisms are analyzed. The solutions found in the development of the SCOT project are recalled. The definition of a transactional base adapted to the SCOT functional requirements is presented. Errors and faults management is discussed. A comparative analysis of lock-out mechanisms allows the identification of access synchronization techniques. The results are used in distributed database systems design. ESA

N86-31955# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INTRODUCTION TO THE PROJECT DESIGN OF A USER'S INTERFACE FOR GRAPHIC-ALPHANUMERICAL DATA BANKS [EINFUEHRUNG IN DAS PROJEKT ENTWURF EINER BENUTZERSCHNITTSTELLE FUER EINE GRAPHISCH-ALPHANUMERISCHE DATENBANK]
Isa Ramm and Hans-Dieter Ehrich *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 1985 p 115-123

In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

N86-31957# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BRIEF REPORT ON DESIGN AND IMPLEMENTATION OF A DATA BANK CORE SYSTEM [KURZBERICH UEBER ENTWURF UND IMPLEMENTIERUNG EINES DATENBANKKERN-SYSTEMS]
Hans-Joerg Schek *In its* Reports on Cartography and Geodesy. Series 1: Original reports, No. 95 1985 p 135-141 In GERMAN; ENGLISH summary (For primary document see N86-31946 23-43)
Avail: NTIS HC A09/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N86-32343# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.
LEGISLATION FOR SOFTWARE RIGHTS PROTECTION AT LAST [ENFIN UN STATUT POUR LA PROTECTION DES LOGICIELS]
Olivier Brun and Marie-France Murphy 1986 5 p
(SNIAS-861-422-114; ESA-86-97601) Avail: NTIS HC A02/MF A01

The deficiencies of French jurisprudence and the content of a law to protect the rights for the exploitation of computer programs are discussed. The positive aspects of the law are shown. ESA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-32344 Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
[RESEARCH ACTIVITIES REPORT OF THE GERMAN FEDERAL GOVERNMENT] Annual Report, 1984 [BUNDESBERICHT FORSCHUNG 1984]
1984 432 p In GERMAN
(ISSN-0722-8333; ESA-86-97413) Avail: Issuing Activity

The orientation and perspectives of the research and technology policy of the West German government are presented. The resources for science, research and development are given. The main Federal requirements for research and technology are explained. The research and technology policy of the States is presented. International cooperation in the field of research and technology is listed. Production and research organizations in the Federal Republic of Germany are presented. ESA

N86-32345# B-K Dynamics, Inc., Rockville, Md.
IDENTIFICATION OF AIR FORCE EMERGING TECHNOLOGIES AND MILITARILY SIGNIFICANT EMERGING TECHNOLOGIES Final Report, 1 Sep. 1984 - 31 Aug. 1985
Patrick P. McDermott 31 Aug. 1985 136 p
(Contract F49620-84-C-0099)
(AD-A167088; BKD-TR-5-763; AFOSR-86-0230TR) Avail: NTIS HC A07/MF A01 CSCL 05/1

The objective of this effort was to review Air Force research and existing emerging technologies lists, to conduct interviews and analyze data in order to identify likely candidates for a Military Emerging Technologies Awareness List (METAL). A METAL was constructed, in consultation with AFOSR, based on original research and interview data. The contract effort consisted of 3 stages: 1) Preparation of a Preliminary Militarily Significant Emerging Technologies List (MSET) from 3 existing Air Force emerging technologies lists. 2) In-depth Interviews at 6 Air Force Laboratories covering 70 topical areas. Technologies were identified, based on criteria outlined in Stage 1, as Mature Technologies, Emerging Technologies, or MSETs. If technologies could be correlated to those in the Militarily Critical Technologies List (MCTL), they were designated as Militarily Critical Technologies (MCTs). Interviews provided discussion of a technology's military significance and sensitivity to public release, and 3) Assessment of Interview Results identified the preliminary METAL, and identified the importance of the interview process in ultimately determining the MSETs. Further efforts are to continue to identify, review, and finalize the Air Force METAL. GRA

N86-32346# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES, VOLUME 40, NUMBER 6 Monthly Report
C. J. Fox Jun. 1986 34 p
(AD-A167501; ESN-40-6-Vol-40-No-6) Avail: NTIS HC A03/MF A01 CSCL 05/2

ESN is a monthly publication with brief articles on recent developments in European scientific research. Topics in this issue include: Acoustics Research at the Inst. for Sound and Vibration Research, Univ. of Southhampton, UK; Biological Science performed at TNO–The Netherlands and the Center of Immunology, Marseille-Luminy, France; Composite Materials Research in Two French Universities; Fracture Mechanics and Welding Research at the Technical Research Center of Finland; Charge-Density Wave Studies in Natural Low Dimensional Materials at Bristol Univ.; and UK Pulsed-Power Group Formed. GRA

N86-32347# European Space Agency, Paris (France).
PREPARING FOR THE FUTURE: THE ESA TECHNOLOGICAL RESEARCH AND DEVELOPMENT PROGRAM 1986-1988 Executive Summary
Norman Longdon, ed. Dec. 1985 55 p Original document contains color illustrations
(ESA-SP-1079; ISSN-0250-1589; ESA-86-97566) Avail: NTIS HC A04/MF A01

European Space Agency work on Earth-space telematics; space communications; infrastructure; global Earth monitoring; deep space and observatory facilities; microgravity utilization; space platforms; in-orbit operations; and maintenance of European competitiveness is outlined. ESA

88 SPACE SCIENCES (GENERAL)

N86-32348*# Lunar and Planetary Inst., Houston, Tex.
WORKSHOP ON COSMOGENIC NUCLIDES
Robert C. Reedy, ed. and Peter Englert, ed. 1986 82 p Workshop held in Los Alamos, N. Mex., 26-27 Jul. 1984; sponsored by LPI and LANL
(Contract NASw-4066)
(NASA-CR-176886; NAS 1.26:176886; LPI-TR-86-06) Avail: NTIS

HC A05/MF A01 CSCL 03B

Abstracts of papers presented at the Workshop on Cosmogenic Nuclides are compiled. The major topic areas covered include: new techniques for measuring nuclides such as tandem accelerator and resonance mass spectrometry; solar modulation of cosmic rays; pre-irradiation histories of extraterrestrial materials; terrestrial studies; simulations and cross sections; nuclide production rate calculations; and meteoritic nuclides. For individual titles, see N86-32349 through N86-32371.

N86-32349*# California Univ., San Diego. Dept. of Chemistry.
NUCLIDE PRODUCTION IN (VERY) SMALL METEORITES c90
James R. Arnold and Kunihiko Nishiizumi *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

One of the most interesting open questions in the study of cosmic-ray effects in meteorites is the expected behavior of objects which are very small compared to the mean interaction length of primary galactic cosmic ray (GCR) particles. A reasonable limit might be a pre-atmospheric radius of 5 gram/cm(2), or 1.5 cm for chondrites. These are interesting for at least three reasons: (1) this is a limiting case for large objects, and can help us make better models; (2) this size is intermediate between usual meteorites and irradiated grams (spherules); and (3) these are the most likely objects to show solar cosmic ray (SCR) effects. Reedy (1984) has recently proposed a model for production by GCR of radioactive and stable nuclides in spherical meteorites. Very small objects are expected to deviate from this model in the direction of fewer secondary particles (larger spectral shape parameter), at all depths. The net effect will be significantly lower production of such low-energy products as Mn-53 and Al-26. The SCR production of these and other nuclides will be lower, too, because meteorite orbits extend typically out into the asteroid belt, and the mean SCR flux must fall off approximately as r(-2) with distance from the Sun. Kepler's laws insure that for such orbits most of the exposure time is spent near aphelion. None the less the equivalent mean exposure distance, R(exp), is slightly less than the semimajor axis A because of the weighting by R(-2). For the three meteorite orbits we have, R(exp) has a narrow range, from about 1.6 to 2.1 a.u. This is probably true for the great majority of meteorites.
M.G.

N86-32350*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
SIMULATION EXPERIMENTS FOR GAMMA-RAY MAPPING OF PLANETARY SURFACES: SCATTERING OF HIGH-ENERGY NEUTRONS c91
J. Brueckner, P. Englert (Cologne Univ. (West Germany).), R. C. Reedy (Los Alamos National Lab., N. Mex.), and H. Waenke *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

The concentration and distribution of certain elements in surface layers of planetary objects specify constraints on models of their origin and evolution. This information can be obtained by means of remote sensing gamma-ray spectroscopy, as planned for a number of future space missions, i.e., Mars, Moon, asteroids, and comets. To investigate the gamma-rays made by interactions of neutrons with matter, thin targets of different composition were placed between a neutron-source and a high-resolution germanium spectrometer. Gamma-rays in the range of 0.1 to 8 MeV were accumulated. In one set of experiments a 14-MeV neutron generator using the T(d,n) reaction as neutron-source was placed in a small room. Scattering in surrounding walls produced a spectrum of neutron energies from 14 MeV down to thermal. This complex neutron-source induced mainly neutron-capture lines and only a few scattering lines. As a result of the set-up, there was a considerable background of discrete lines from surrounding materials. A similar situation exists under planetary exploration conditions: gamma-rays are induced in the planetary surface as well as in the spacecraft. To investigate the contribution of neutrons with higher energies, an experiment for the measurement of prompt gamma radiation was set up at the end of a beam-line of an isochronous cyclotron.
M.G.

N86-32351*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
PRECOMPACTION IRRADIATION EFFECTS: PARTICLES FROM AN EARLY ACTIVE SUN? c92
M. W. Caffee, J. N. Goswami (Physical Research Lab., Ahmedabad (India).), C. M. Hohenberg, and T. D. Swindle *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

Two recent studies have shown that solar flare irradiated grains from Murchison and Kapoeta have excess spallogenic Ne-21 compared to unirradiated grains, indicating large precompaction particle irradiation effects. The quantity of cosmogenic neon in these grains presents serious difficulties for either galactic cosmic ray or normal solar flare sources. In the first study it was suggested that the effect might be the result of exposure to an early active sun. The more recent experiment both confirms the earlier results and provides constraints on the characteristic energy spectrum on the irradiation. The first results were obtained from Murchison olivines and Kapoeta pyroxenes by mass spectrometric analysis of sets of grains selected on the basis of the presence or absence of solar flare particle tracks. In the second work plagioclase feldspar grains from Kapoeta were studied.
M.G.

N86-32352*# Rochester Univ., N. Y. Nuclear Structure Research Lab.
DETERMINATION OF CA-41, I-129 AND OS-187 IN THE ROCHESTER TANDEM ACCELERATOR AND SOME APPLICATIONS OF THESE ISOTOPES c72
U. Fehn, D. Elmore, H. E. Gove, P. Kubik, R. Teng, and L. Tubbs *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 20H

The measurement of Ca-41 and I-129 utilizing the Rochester Tanden Accelerator Mass Spectrometer (TAMS) is discussed. Ca-41, having a half-life of 100,000 yrs., is of potential use for the dating of ground water as well as of bones in the age range between 50,000 and 1 million yrs. A major problem for the measurement of Ca-41 with TAMS is the fact that calcium does not readily form negative atomic ions. It does, however, form negative molecular ions. The production of CaO ions from compounds such as CaO and CaCO3 and from free Ca molecules sprayed with oxygen gas was studied. A project to utilize I-129 as a tracer for hydrothermal convection in sediment-covered oceanic crust is also briefly described. Finally, plans to use the Os-187/Os-186 ratio for the determination of extraterrestrial material in the Ries crater in Germany are summarized.
M.G.

N86-32353*# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
SOLAR MODULATION OF GALACTIC COSMIC RAYS: CONTEMPORARY OBSERVATIONS AND THEORIES c92
M. A. Forman *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

The flux of galactic cosmic rays inside the solar system is modulated by the action of the complex magnetic fields carried from the Sun by the solar wind. This is apparent from the recurrent decrease of about 20% in the intensity of relativistic cosmic rays during sunspot maximum compared to sunspot minimum, from transient decreases due to solar flares and many other more subtle effects observed by ground stations for the last 50 years. Spacecraft observations of the spatial and temporal variations of cosmic ray flux during the last ten years have shown that the solar wind and cosmic-ray modulation extend to at least 30 astronomical units in the ecliptic plane. Present best guesses are that it goes out to 100 or 200 AU, perhaps less over the poles. Theories describing the mechanism of solar modulation are outlined

and the importance of having a firm understanding of this mechanism to the study of other astrophysical phenomena is discussed. M.G.

N86-32354*# Physical Research Lab., Ahmedabad (India).
EVOLUTION OF GAS-RICH METEORITES: CLUES FROM COSMOGENIC NUCLIDES c90
J. N. Goswami *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

The evolution of gas-rich meteorites in general, and the setting in which the observed solar-wind, solar-flare irradiation records were imprinted in individual components of these meteorites are understood only in qualitative terms, although contrary viewpoints do exist. The regolith irradiation hypothesis, bolstered by the observations of irradiation features in lunar regolith materials, similar to those observed in gas-rich meteorites, is accepted by many workers in this field. However, a close analysis of the problem suggests that the regolith irradiation may not be the dominant mode in producing the observed precompaction irradiation features in the gas-rich meteorites. M.G.

N86-32355*# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
THE EXPOSURE HISTORY OF JILIN AND PRODUCTION RATES OF COSMOGENIC NUCLIDES c90
G. Heusser *In* Lunar and Planetary Inst. Workshop on cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

Jilin, the largest known story meteorite, is a very suitable object for studying the systematics of cosmic ray produced nuclides in stony meteorites. Its well established two stage exposure history even permits to gain information about two different irradiation geometries (2pi and 4pi). All stable and long-lived cosmogenic nuclides measured in Jilin so far correlate well with each other. An example is shown where the Al-26 activities are plotted vs. the spallogenic Ne-21 concentration. These records of cosmic-ray interaction in Jilin can be used both to determine the history of the target and to study the nature of production rate profiles. This is unavoidably a bootstrap process, involving studying one with assumption about the other. Production rate equations are presented and discussed. M.G.

N86-32356*# Arizona Univ., Tucson. NSF Accelerator Facility for Radioisotope Analysis
RADIONUCLIDE MEASUREMENTS BY ACCELERATOR MASS SPECTROMETRY AT ARIZONA c90
A. J. T. Jull, D. J. Donahue, and T. H. Zabel *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

Over the past years, Tandem Accelerator Mass Spectrometry (TAMS) has become established as an important method for radionuclide analysis. In the Arizona system the accelerator is operated at a thermal voltage of 1.8MV for C-14 analysis, and 1.6 to 2MV for Be-10. Samples are inserted into a cesium sputter ion source in solid form. Negative ions sputtered from the target are accelerated to about 25kV, and the injection magnet selects ions of a particular mass. Ions of the 3+ charge state, having an energy of about 9MeV are selected by an electrostatic deflector, surviving ions pass through two magnets, where only ions of the desired mass-energy product are selected. The final detector is a combination ionization chamber to measure energy loss (and hence, Z), and a silicon surface-barrier detector which measures residual energy. After counting the trace isotope for a fixed time, the injected ions are switched to the major isotope used for normalization. These ions are deflected into a Faraday cup after the first high-energy magnet. Repeated measurements of the isotope ratio of both sample and standards results in a measurement of the concentration of the radionuclide. Recent improvements in sample preparation for C-14 make preparation of high-beam current graphite targets directly from CO2 feasible. Except for some measurements of standards and backgrounds for Be-10 measurements to date have been on C-14. Although most results have been in archaeology and quaternary geology, studies have been expanded to include cosmogenic C-14 in meteorites. The data obtained so far tend to confirm the antiquity of Antarctic meteorites from the Allan Hills site. Data on three samples of Yamato meteorites gave terrestrial ages of between about 3 and 22 thousand years. M.G.

N86-32357*# Scripps Institution of Oceanography, La Jolla, Calif. Geological Research Div.
COSMIC RAY INTERACTIONS IN THE GROUND: TEMPORAL VARIATIONS IN COSMIC RAY INTENSITIES AND GEOPHYSICAL STUDIES c93
D. Lal *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

Temporal variations in cosmic ray intensity have been deduced from observations of products of interactions of cosmic ray particles in the Moon, meteorites, and the Earth. Of particular interest is a comparison between the information based on Earth and that based on other samples. Differences are expected at least due to: (1) differences in the extent of cosmic ray modulation, and (2) changes in the geomagnetic dipole field. Any information on the global changes in the terrestrial cosmic ray intensity is therefore of importance. In this paper a possible technique for detecting changes in cosmic ray intensity is presented. The method involves human intervention and is applicable for the past 10,000 yrs. Studies of changes over longer periods of time are possible if supplementary data on age and history of the sample are available using other methods. Also discussed are the possibilities of studying certain geophysical processes, e.g., erosion, weathering, tectonic events based on studies of certain cosmic ray-produced isotopes for the past several million years. M.G.

N86-32358*# Lawrence Livermore National Lab., Calif.
PRODUCTION RATES OF NEON XENON ISOTOPES BY ENERGETIC NEUTRONS c25
D. A. Leich, R. J. Borg, and V. B. Lanier *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 07D

As a first step in an experimental program to study the behavior of noble gases produced in situ in minerals, a suite of minerals and pure chemicals were irradiated with 14.5 MeV neutrons at LLNL's Rotating Target Neutron Source (RTNS-II) and production rates for noble gases were determined. While neutron effects in meteorites and lunar samples are dominated by low-energy neutron capture, more energetic cosmic-ray secondary neutrons can provide significant depth-dependent contributions to production of cosmogenic nuclides through endothermic reactions such as (n,2n), (n,np), (n,d) and (n,alpha). Production rates for nuclides produced by cosmic-ray secondary neutrons are therefore useful in interpreting shielding histories from the relative abundances of cosmogenic nuclides. Absolute production cross sections were calculated from isotope dilution analyses of NaCl, Mg, CsCl, and Ba(NO3)2 samples, assuming purity, stoichiometry, and quantitative noble gas retention and extraction. Relative production cross sections determined from neon isotopic ratios in the mineral samples were also considered in evaluating the neon production cross sections. Results are presented. M.G.

N86-32359*# California Univ., San Diego, La Jolla.
LIVE 129I-129Xe DATING c72
Kurt Marti *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 20H

A technique of cosmic ray exposure age dating using cosmic ray produced I-129 and Xe-129 components is discussed. The live I-129 - Xe-129 method provides an ideal monitor for cosmic ray flux variations on the 10(7)y - 10(8)y time-scale. It is based on low-energy neutron reactions on Te, and these data, when

coupled to those from other methods, may facilitate the detection of complex exposure histories. M.G.

N86-32360*# Cologne Univ. (West Germany). Inst. for Kernchemie.
PRODUCTION OF RADIONUCLIDES IN ARTIFICIAL METEORITES IRRADIATED ISOTROPICALLY WITH 600 MeV PROTONS c90
R. Michel, P. Dragovitsch, P. Englert, and U. Herpers *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 4 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

The understanding of the production of cosmogenic nuclides in small meteorites (R is less than 40 cm) still is not satisfactory. The existing models for the calculation of depth dependent production rates do not distinguish between the different types of nucleons reacting in a meteorite. They rather use general depth dependent particle fluxes to which cross sections have to be adjusted to fit the measured radionuclide concentrations. Some of these models can not even be extended to zero meteorite sizes without logical contradictions. Therefore, a series of three thick target irradiations was started at the 600 MeV proton beam of the CERN isochronuous cyclotron in order to study the interactions of small stony meteorites with galactic protons. The homogeneous 4 pi irradiation technique used provides a realistic meteorite model which allows a direct comparison of the measured depth profiles with those in real meteorites. Moreover, by the simultaneous measurement of thin target production cross sections one can differentiate between the contributions of primary and secondary nucleons over the entire volume of the artificial meteorite. M.G.

N86-32361*# Los Alamos National Lab., N. Mex.
RESONANCE IONIZATION MASS SPECTROMETRY FOR ISOTOPIC ABUNDANCE MEASUREMENTS c25
C. M. Miller *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 07D

Resonance ionization mass spectrometry (RIMS) is a relatively new laser-based technique for the determination of isotopic abundances. The resonance ionization process depends upon the stepwise absorption of photons from the laser, promoting atoms of the element of interest through progressively higher electronic states until an ion is formed. Sensitivity arises from the efficiency of the resonant absorption process when coupled with the power available from commercial laser sources. Selectivity derives naturally from the distinct electronic structure of different elements. This isobaric discrimination has provided the major impetus for development of the technique. Resonance ionization mass spectrometry was used for analysis of the isotopic abundances of the rare earth lutetium. Isobaric interferences from ytterbium severely effect the ability to measure small amounts of the neutron-deficient Lu isotopes by conventional mass spectrometric techniques. Resonance ionization for lutetium is performed using a continuous-wave laser operating at 452 nm, through a sequential two-photon process, with one photon exciting the intermediate resonance and the second photon causing ionization. Ion yields for microgram-sized quantities of lutetium lie between 10(6) and 10(7) ions per second, at overall ionization efficiencies approaching 10(-4). Discrimination factors against ytterbium greater than 10(6) have been measured. Resonance ionization for technetium is also being explored, again in response to an isobaric interference, molybdenum. Because of the relatively high ionization potential for Tc, three-photon, two-color RIMS processes are being developed. M.G.

N86-32362*# California Univ., San Diego. Dept. of Chemistry.
COMPILATION OF COSMOGENIC RADIONUCLIDES IN METEORITES c90
Kunihiko Nishiizumi *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

All available data for the concentration of cosmogenic nuclides Mn-53(t(1/2) = 3.7 x 10(6) years), Al-26 (7.05 x 10(5) years), Be-10 (1.6 x 10(6) years), Cl-36 (3.0 x 10(5) years) and Ne-21, and Ne-22/Ne-21 ratios in stony, iron, and stony-iron meteorites were compiled. For iron meteorites, the He-4/Ne-21 ratio was adopted instead of Ne-22/Ne-21 ratio, because the He-4/Ne-21 ratio in iron meteorites indicates the shielding condition of the sample. The compilation contains over 2000 different analyses for four cosmogenic radionuclides. Author

N86-32363*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REDETERMINATION OF PARAMETERS FOR SEMI-EMPIRICAL MODEL FOR SPALLOGENIC He AND Ne IN CHONDRITES c90
L. E. Nyquist and A. F. McDowell (Lunar and Planetary Inst., Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

A semi-empirical model described previously satisfactorily reproduced a number of shielding-dependent variations in the relative production rates of spallogenic He and Ne in chondrites. However, data for cores of the Keyes and St. Severin meteorites showed a subsurface build-up in He-3 which was not predicted with the original model parameters and the model was not pursued. Renewed interest in the preatmospheric size of meteorites, spurred in part by the desirability of understanding the exposure history of the SNC meteorites, justifies redetermination of model parameters. M.G.

N86-32364*# Department of Energy, New York. Environmental Measurements Lab.
CALCULATIONS OF COSMOGENIC NUCLIDE PRODUCTION RATES IN THE EARTH'S ATMOSPHERE AND THEIR INVENTORIES c46
Keran OBrien *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 04A

The production rates of cosmogenic isotopes in the Earth's atmosphere and their resulting terrestrial abundances have been calculated, taking into account both geomagnetic and solar-modulatory effects. The local interstellar flux was assumed to be that of Garcia-Munoz, et al. Solar modulation was accounted for using the heliocentric potential model and expressed in terms of the Deep River neutron monitor count rates. The geomagnetic field was presented by vertical cutoffs calculated by Shea and Smart and the non-vertical cutoffs calculated using ANGRI. The local interstellar particle flux was first modulated using the heliocentric potential field. The modulated cosmic-ray fluxes reaching the earth's orbit then interacted with the geomagnetic field as though it were a high-pass filter. The interaction of the cosmic radiation with the Earth's atmosphere was calculated utilizing the Bolztmann transport equation. Spallation cross sections for isotope production were calculated using the formalism of Silberberg and Tsao and other cross sections were taken from standard sources. Inventories were calculated by accounting from the variation in solar modulation and geomagnetic field strength with time. Results for many isotope, including C-14, Be-7 and Be-10 are in generally good agreement with existing data. The C-14 inventory, for instance, amounts to 1.75/sq cm(e)/s, in excellent agreement with direct estimates. M.G.

N86-32365*# Rutgers Univ., New Brunswick, N. J. Dept. of Chemistry.
THE 10Be CONTENTS OF SNC METEORITES c90
D. K. Pal, C. Tuniz (Istituto Nazionale di Fisica Nucleare, Trieste (Italy).), R. K. Moniot (Fordham Univ., New York, N.Y.), W. Savin (New Jersey Inst. of Tech., Newark.), S. Vajda, T. Kruse, and G. F. Herzog *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

Several authors have explored the possibility that the Shergot-

tites, Nakhlites, and Chassigny (SNC) came from Mars. The spallogenic gas contents of the SNC meteorites have been used to: constrain the sizes of the SNC's during the last few million years; to establish groupings independent of the geochemical ones; and to estimate the likelihood of certain entries in the catalog of all conceivable passages from Mars to Earth. The particular shielding dependence of Be-10 makes the isotope a good probe of the irradiation conditions experienced by the SNC meteorites. The Be-10 contents of nine members of the group were measured using the technique of accelerator mass spectrometry. The Be-10 contents of Nakhla, Governador Valadares, Chassigny, and probably Lafayette, about 20 dpm/kg, exceed the values expected from irradiation of the surface of a large body. The Be-10 data therfore do not support scenario III of Bogard et al., one in which most of the Be-10 in the SNC meteorites would have formed on the Martian surface; they resemble rather the Be-10 contents found in many ordinary chondrites subjected to 4 Pi exposures. The uncertainties of the Be-10 contents lead to appreciable errors in the Be-10 ages, t(1) = -1/lambda ln(1 Be-10/Be-10). Nonetheless, the Be-10 ages are consistent with the Ne-21 ages calculated assuming conventional, small-body production rates and short terrestrial ages for the finds. It is believed that this concordance strengthens the case for at least 3 different irradiation ages for the SNC meteorites. Given the similar half-thicknesses of the Be-10 and Ne-21 production rates, the ratios of the Be-10 and Ne-21 contents do not appear consistent with common ages for any of the groups. In view of the general agreement between the Be-10 and Ne-21 ages it does not seem useful at this time to construct multiple-stage irradiation histories for the SNC meteorites. M.G.

N86-32366*# Cologne Univ. (West Germany). Inst. fuer Kernchemie.

STUDIES ON COSMOGENIC NUCLIDES IN METEORITES WITH REGARD TO AN APPLICATION AS POTENTIAL DEPTH INDICATORS **c90**

R. Sarafin, U. Herpers, P. Englert, R. Wieler (Eidgenoessische Technische Hochschule, Zurich (Switzerland).), P. Signer, G. Bonani, H. J. Hofmann, E. Morenzoni, M. Nessi, M. Suter et al *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)

Avail: NTIS HC A05/MF A01 CSCL 03B

Measurements of stable and radioactive spallation products in meteorites allow to investigate their histories, especially with respect to the exposure to galactic cosmic ray particles and the pre-atmospheric size of the object. While the concentrations of spallation products lead to the determination of exposure and terrestrial ages, production rate ratios are characteristic for the location of the sample in the meteorite. So, one of the aims of this investigation on meteorites is to obtain depth indicators from suitable pairs of cosmogenic nuclides. Because of the different depth profiles for nuclide productions it is necessary to determine the concentrations of a larger number of spallation products in aliquots of a single small sample. Such same sample measurements of Be-10 and light noble gases were performed on 15 ordinary chondrites (7 H- and 8 L-chondrites. Be-10 was determined by accelerator mass spectrometry and the noble gases were measured by static mass spectrometry. The results are summarized and discussed. Author

N86-32367*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).

THE PRODUCTION RATE OF COSMOGENIC 21-Ne IN CHONDRITES DEDUCED FROM 81-Kr MEASUREMENTS **c90**

L. Schultz and M. Freundel *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)

Avail: NTIS HC A05/MF A01 CSCL 03B

Cosmogenic Ne-21 is used widely to calculate exposure ages of stone meteorites. In order to do so, the production rate P(21) must be known. This rate, however, is dependent on the chemical composition of the meteorite as well as the mass of, and position within, the meteoroid during its exposure to the cosmic radiation. Even for a mean shielding the production rates determined from measurments of different radionuclides vary by a factor of two. A method that can be used to determine exposure ages of meteorites that avoids shielding and chemical composition corrections is the -81-Kr-Kr-method. However, for chondrites, in many cases, the direct determination of production rates for the Kr isotopes is prevented by the trapped gases and the neutron effects on bromine. Therefore, this method was applied to four eucrite falls and then their 81-Kr-83-Kr-ages were compared to their cosmogenic Ne-21 and Ar-38 concentrations. The eucrites Bouvante-le-Haut, Juvinas, Sioux County, and Stannern were chosen for these measurements because of their similar chemical composition regarding the major elements. Author

N86-32368*# Arizona Univ., Tucson. Dept. of Planetary Sciences.

A DIRECT TIME SERIES COMPARISON BETWEEN THE LA JOLLA AND BELFAST RADIOCARBON RECORDS **c90**

C. P. Sonett and H. E. Suess (California Univ., San Diego.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)

Avail: NTIS HC A05/MF A01 CSCL 03B

For many years it has been widely assumed that the variations in the level of atmospheric carbon-14 were due to statistical fluctuations arising from experimental error. This is understandable since the signal/noise ratio is very low and the time sequences representing the variations are strongly stochastic. Interlaboratory comparisons show that baseline variations in the absolute value of the carbon-14 concentration do exist. However, assuming linearity, the delta 14C values are independent of these. The importance of assessing the quantitive reality of the delta 14C values is based upon their expression of the interplanetary cosmic ray source function, because in the range of 100 to 1000 year periods, there appears to be no evidence that the Earth's magnetic field is the source modulating function. Therefore the modulation is either due to changes in the solar atmosphere propagated out into the solar wind, or extra-heliospheric pressure effects, but these appear to be unlikely for the periods noted here. The recent availability of the new high quality Belfast time sequence of delta 14C now permits a simple mutual assessment of the several sequences which are available. Since the La Jolla record has been a standard for many years , these two were chosen for a simple comparison. Although differences exist, the close agreement between these two sequences, one carried out on White mountain Bristlecone pines, and the other done using Irish peat bog wood, is striking. This correlation between the two strongly reinforces the statistical view that the delta 14C record is that of real interplanetary modulation of the cosmic ray source leading to the generation of atmospheric 14C. M.G.

N86-32369*# York Coll., Jamaica, N. Y.

NEUTRON CAPTURE PRODUCTION RATES OF COSMOGENIC 60Co, 59NI AND 36Cl IN STONY METEORITES **c90**

M. S. Spergel, R. C. Reedy (Los Alamos National Lab., N. Mex.), O. W. Lazareth (Brookhaven National Lab., Upton, N. Y.), and P. W. Levy *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)

Avail: NTIS HC A05/MF A01 CSCL 03B

Results for neutron flux calculations in stony meteoroids (of various radii and compositions) and production rates for Cl-36, Ni-59, and Co-60 are reported. The Ni-59/Co-60 ratio is nearly constant with depth in most meteorites: this effect is consistent with the neutron flux and capture cross section properties. The shape of the neutron flux energy spectrum, varies little with depth in a meteorite. The size of the parent meteorite can be determined from one of its fragments, using the Ni-59/Co-60 ratios, if the parent meteorite was less than 75 g/cm(2) in radius. If the parent meteorite was larger, a lower limit on the size of the parent meteorite can be determined from a fragment. In C3 chondrites this is not possible. In stony meteorites with R less than 50 g/cm(2) the calculated Co-60 production rates (mass less than 4 kg), are below 1 atom/min g-Co. The highest Co-60 production rates occur in stony meteorites with radius about 250 g/cm(2) (1.4 m across). In meteorites with radii greater than 400 g/cm(2), the maximum

Co-60 production rate occurs at a depth of about 175 g/cm(2) in L-chondrite, 125 g/cm(2) in C3 chrondrite, and 190 g/cm(2) in aubrites. M.G.

N86-32370*# Cologne Univ. (West Germany). Inst. fuer Kernchemie.
SIMULATION OF COSMIC IRRADIATION CONDITIONS IN THICK TARGET ARRANGEMENTS **c93**
S. Theis, P. Englert, R. C. Reedy (Los Alamos National Lab., N. Mex.), and J. R. Arnold (California Univ., San Diego.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

One approach to simulate 2-pi irradiation conditions of planetary surfaces which has been widely applied in the past are bombardments of so called thick targets. A very large thick target was exposed recently to 2.1 GeV protons at the Bevatron-Bevalac in Berkeley. In a 100x100x180 cm steel-surrounded granodiorite target radioactive medium and high energy spallation products of the incident primary and of secondary particles were analyzed along the beam axis down to depths of 140 g/cm(2) in targets such as Cu, Ni, Co, Fe, T, Si, SiO2 and Al. Activities of these nuclides were exclusively determined via instrumental gamma-ray spectroscopy. Relative yields of neutron capture and spallation products induced in Co and Cu targets during the thick target bombardment are shown as a function of depth. The majority of the medium energy products such as Co-58 from Co targets exhibit a maximum at shallow depths of 40-60 g/cm(2) and then decrease exponentially. In a comparable 600 MeV proton bombarded thick target such a slight maximum for medium energy products was not observed. Rather, Co-58 activities in Co decreased steadily with the highest activity at the surface. The activities of the n-capture product Co-60 increase steadily starting at the surface. This indicates the rapidly growing flux of low energy neutrons within the target. M.G.

N86-32371*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
COSMOGENIC RARE GASES AND 10-Be IN A CROSS SECTION OF KNYAHINYA **c90**
R. Wieler, P. Signer, U. Herpers (Cologne Univ. (West Germany).), R. Sarafin, G. Bonani, H. J. Hofmann, E. Morenzoni, M. Nessi, M. Suter, and W. Woelfli *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

The concentrations of cosmogenic nuclides were studied as a function of shielding on samples from a cross section of the 293 kg main fragment of the L5 chondrite Knyahinya. The stone broke into two nearly symmetrical parts upon its fall in 1866. The planar cross section has diameters between 40 and 55 cm. He, Ne, and Ar were measured on about 20 samples by mass spectrometry and the 10-Be activities on aliquots of 10 selected samples were determined by AMS. The 10-Be data are presented and the abundances of spallogenic nuclides are compared with the model calculations reported by Reedy for spherical L chondrites. The 10-Be production rates in Knyahinya are shown versus the shielding parameter 22-Ne/21-Ne. M.G.

N86-32372# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
[ACTIVITIES REPORT OF THE INSTITUTE OF EXTRATERRESTRIAL PHYSICS] Progress Report, 1985 [TAETIGKEITSBERICHT 1985]
Jan. 1986 122 p In GERMAN Original document contains color illustrations
(MPE-194; ISSN-0173-699X; ESA-86-97476) Avail: NTIS HC A06/MF A01

Reconnection in magnetized plasmas, pickup ions in the solar wind, and quasiperiodic oscillations are discussed. The Active Magnetospheric Particle Tracer Explorer experiment; magnetospheric plasma; energetic ions and electrons in the magnetosphere; and interplanetary space are treated. X-ray and IR astronomy observation systems and theoretical work; and gamma astronomy flare and burst phenomena are treated. In laboratory astrophysics, molecular spectroscopical and theoretical research was performed, and the dynamics of multimode lasers was investigated. ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-32373*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A DIGITAL IMAGING PHOTOMETRY SYSTEM FOR COMETARY DATA ACQUISITION Center Director's Discretionary Fund Final Report
K. S. Clifton, C. M. Benson, and G. A. Gary Jul. 1986 28 p
(NASA-TM-86554; NAS 1.15:86554) Avail: NTIS HC A03/MF A01 CSCL 03A

This report describes a digital imaging photometry system developed in the Space Science Laboratory at the Marshall Space Flight center. The photometric system used for cometary data acquisition is based on an intensified secondary electron conduction (ISEC) vidicon coupled to a versatile data acquisition system which allows real-time interactive operation. Field tests on the Orion and Rosette nebulas indicate a limiting magnitude of approximately m sub v = 14 over the 40 arcmin field-of-view. Observations were conducted of Comet Giacobini-Zinner in August 1985. The resulting data are discussed in relation to the capabilities of the digital analysis system. The development program concluded on August 31, 1985. Author

N86-32374*# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
BOUNDARY CONDITIONS FOR THE PALEOENVIRONMENT: CHEMICAL AND PHYSICAL PROCESSES IN THE PRE-SOLAR NEBULA Semiannual Status Report, 16 Feb. - 15 Aug. 1986
William M. Irvine and F. Peter Schloerb 1986 11 p
(Grant NAGw-436)
(NASA-CR-176870; NAS 1.26:176870; SASR-7) Avail: NTIS HC A02/MF A01 CSCL 03A

The first interstellar hydrocarbon ring, cyclopropenylidene (C3H2) is being studied. Both a survey of galactic sources in several C3H2 transitions and a more detailed study of a subset of these sources are under way. In the latter category is a study of the nearby cold dark cloud TMC-1, which is a potential formation site for solar type stars. A spectra is shown of seven rotational transitions which have been observed at the Five College Radio Astronomy Observatory. Three of these were detected for the first time in any astronomical source: the 3 sub 30 to 2 sub 21 transition at 216 GHz, the 2 sub 21 to 1 sub 10 transition at 122 GHz, and the 1 sub 11 to 0 sub 00 transition at 52 GHz. From the data it is apparent that C3H2 is quite spacially extended in typical interstellar molecular clouds, and that at least in TMC-1 it is one of the most abundant organic molecules. E.R.

N86-32375*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXTREME LIMB PROFILES OF THE SUN AT FAR-INFRARED AND SUBMILLIMETER WAVELENGTHS
C. Lindsey (Hawaii Univ., Honolulu.), E. E. Becklin, F. Q. Orrall, M. W. Werner, J. T. Jefferies (National Optical Astronomy Lab. Tucson, Ariz.), and I. Gatley (United Kingdom Infrared Telescope Unit, Hilo, Hawaii.) Jun. 1986 41 p
(NASA-TM-88251; A-86236; NAS 1.15:88251) Avail: NTIS HC A03/MF A01 CSCL 03A

Thirty, 50, 100, and 200 microns solar limb intensity profiles determined with arcsecond resolution from airborne observations of the occultation of the solar limb during the total eclipse of 1981 July 31 are presented. Two points of particular importance emerge: (1) the longer-wavelength (100 and 200 micron) limbs are significantly brighter than disk center. At 200 microns the

extreme limb is about 1.22 times the brightness of disk center. This is consistent with the 6000 K temperature-plateau structure of the model chromospheres of Vernazza, Avrett, and Loeser (1973, Ap. J., 184, 605; 1981; Ap. J. Suppl., 45, 635;), and (2) the longer wavelength limbs are extended significantly further above the visible limb than Vernazza, Avrett, and Loeser predict. These results provide a strong basis for modeling of the solar chromosphere free from the assumption of gravitational-hydrostatic equilibrium.
Author

N86-32376*# Delaware Univ., Newark.
ULTRAVIOLET OBSERVATIONS OF ASTRONOMICAL PHENOMENA Final Report
Dermott J. Mullan 9 Sep. 1986 28 p
(Grant NAG5-556)
(NASA-CR-176859; NAS 1.26:176859) Avail: NTIS HC A03/MF A01 CSCL 03A

The purpose was to study various aspects of mass loss in stars of different types. The observational part of the research was directed at three Cepheid variables; the archival part of the research was directed at hot stars (for information on corotating interaction regions) and at cool giants (for study of variability in the mass losing part of the atmosphere).
Author

N86-32377*# National Bureau of Standards, Boulder, Colo. Joint Inst. for Lab. Astrophysics
DEFINITION AND EMPIRICAL STRUCTURE OF THE RANGE OF STELLAR CHROMOSPHERES-CORONAE ACROSS THE H-R DIAGRAM: COOL STARS
Jeffrey L. Linsky 23 Sep. 1986 34 p
(Grants NGL-06-003-057; NAG5-82)
(NASA-CR-176863; NAS 1.26:176863) Avail: NTIS HC A03/MF A01 CSCL 03A

Major advances in our understanding of non-radiative heating and other activity in stars cooler than T sub eff = 10,000K has occured in the last few years. This observational evidence is reviewed and the trends that are now becoming apparent are discussed. The evidence for non-radiatively heated outer atmospheric layers (chromospheres, transition regions, and coronae) in dwarf stars cooler than spectral type A7, in F and G giants, pre-main sequence stars, and close bindary systems is unambiguous, as is the evidence for chromospheres in the K and M giants and supergiants. The existence of non-radiative heating in the outer layers of the A stars remains undetermined despite repeated searches at all wavelengths. Two important trends in the data are the decrease in plasma emission measure with age on the main sequence and decreasing rotational velocity. Variability and atmospheric inhomogeneity are commonly seen, and there is considerable evidence that magnetic fields define the geometry and control the energy balance in the outer atmospheric layers. In addition, the microwave observations imply that non-thermal electrons are confined in coronal magnetic flux tubes in at least the cool dwarfs and RS CVn systems. The chromospheres in the K and M giants and supergiants are geometrically extended, as are the coronae in the RS CVn systems and probably also in other stars.
Author

N86-32378*# Texas Univ., Austin. Dept. of Astronomy.
[ACTIVITIES OF THE DEPARTMENT OF ASTRONOMY AND MCDONALD OBSERVATORY OF THE UNIVERSITY OF TEXAS AT AUSTIN] Semiannual Report, 1 Jan. - 30 Jun. 1986
Harlan J. Smith 1986 12 p
(Grant NGR-44-012-152)
(NASA-CR-179667; NAS 1.26:179667; SAR-25) Avail: NTIS HC A02/MF A01 CSCL 03A

McDonald Observatory of the University of Texas at Austin reports on its activities during the period 1 Jan. 1986 to 30 June 1986. Extensive observations of Halley's Comet were obtained. The comet exhibited large variability; moreover, its variability was much more rapid than can be accounted for by water vaporization as the sole controller of activity. Jupiter satellite Io's atmosphere was found to be distended by more than the equilibrium scale height but less than for unimpeded streaming into space. The atmosphere is at least temporarily bound to IO. Uranus' (3-0) H2 quadrupole line shapes require a modification of Baines and Bergstralh's standard model which incorporates at high altitude absorbing haze in addition to the lower haze layer. A fraction of normal H2 equal to 0.25 + or 0.10 is derived, in good agreement with the standard model. This result is unchanged when the preliminary temperature structure derived by the Voyager Radio Occultation Experiment is used instead of Appleby's model c. Out of the six Pluto-Charon mutual events observed this year, data were obtained on four. Preliminary analysis is yielding improved estimates for the diameters, masses, densities, and albedos of these objects.
Author

N86-32379# Max-Planck-Inst. fuer Astronomie, Heidelberg (West Germany).
THE PHOTOPOLARIMETER OF THE INFRARED SPACE TELESCOPE GIRL: MECHANICAL AND ELECTRICAL COMPONENTS FOR CRYOVACUUM Final Report, Jun. 1985
Wilhelm Martin, Dietrich Lemke, Horst Bauer, Heinrich Bellmann, and Alfred Krabbe Bonn, West Germany Bundesministerium fuer Forschung und Technologie Dec. 1985 50 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-026; ISSN-0170-1339; ESA-86-97468) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany, DM 10.50

A ratchet was developed for photopolarimeter filters, apertures, and polarizers for operation at cryogenic temperatures. It allows accurate discrete positioning in space applications. Hall probes used for position recognition were studied as regards sensitivity, reproducibility, and reliability. Point contacts for filter and aperture wheel, and cooling in liquid helium were tested, to achieve high sensitivity and photometric accuracy of the photopolarimeter and to protect it against thermal interference radiation. Capacitors, displacement transducers, photodetectors, and light emitting diodes were tested for application at low temperatures. These mechanical and electrical components can be integrated in the GIRL photopolarimeter consisting of 2 identical photometers covering the 3 to 30 and 30 to 200 micron ranges to be applied in cryovacuum.
ESA

N86-32380# European Southern Observatory, Munich (West Germany).
[ACTIVITIES REPORT IN ASTRONOMY] Annual Report, 1985
L. Woltjer 1985 91 p In ENGLISH, GERMAN and FRENCH
(ISSN-0531-4496; ESA-86-97551) Avail: NTIS HC A05/MF A01

Ground based astronomical research concerning galaxies, quasars, the Magellanic clouds, interstellar matter, clusters and galactic structure, X-ray sources, stars, and the solar system is summarized.
ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-32381*# California Inst. of Tech., Pasadena.
REDUCTION AND ANALYSIS OF DATA FROM EXPERIMENT CAI ON THE IMP-8 MISSION Final Report, 24 Mar. 1980 - 31 Dec. 1984
E. C. Stone and R. A. Mewaldt 1984 10 p
(Contract NAS5-25789)
(NASA-CR-177891; NAS 1.26:177891) Avail: NTIS HC A02/MF A01 CSCL 03B

The Caltech Electron/Isotope Spectrometer (EIS) on the Interplanetary Monitoring Platform 8 (IMP-8) has provided precise measurements of the energy spectra and time variations of low energy electrons (0.16 to 6 MeV), the isotopes of hydrogen and helium (approximately 2 to 40 MeV/nucleon), and the elements from lithium through oxygen (approximately 5 to 50 MeV/nucleon) in energetic particle fluxes of solar, galactic, interplanetary, and

magnetospheric origin since 1973. The accomplishments that have resulted from EIS measurements during the period March 24, 1980 to December 31, 1984 are summarized. Author

N86-32382*# California Univ., Los Angeles. Dept. of Astronomy.
A SIRTF INTERDICIPLINARY SCIENTIST PROPOSAL Semiannual Technical Report, 1 Apr. - 12 Sep. 1986
Edward L. Wright 12 Sep. 1986 60 p
(Grant NAG2-315)
(NASA-CR-176862; NAS 1.26:176862) Avail: NTIS HC A04/MF A01 CSCL 03B

Segal's chronometric cosmology provides an adequate fit to the radio source counts only for an unrealistic choice of spectral index. Since the typical observed spectral index of 0.75 gives a completely unacceptable X squared = 136 with 24 (or fewer) degrees of freedom, it is concluded that the actual Universe does not fit the chronometric model. Counts of ultraviolet excess quasistellar objects also show a steep N(S) curve that the chronometric cosmology cannot explain. Claims to the contrary by Segal, Loncaric, and Segal (1980) and Segal and Nicoll (1986) depend on a seemingly innocuous assumption that in fact destroys the power of the N(S) test. Even though the chronometric model gives a better fit that other non-evolving models it must be ruled out along with all non-evolving cosmologies. Author

N86-32383# Fermi National Accelerator Lab., Batavia, Ill.
GAUGE ANOMALIES, GRAVITATIONAL ANOMALIES AND SUPERSTRINGS
W. A. Bardeen Aug. 1985 17 p Presented at the INS International Symposium on Composite Models of Quarks and Leptons, Tokyo, Japan, 13 Aug. 1985
(Contract DE-AC02-76CH-03000)
(DE86-005489; FNAL/C-85/110-T; CONF-8508151-2) Avail: NTIS HC A02/MF A01

The structure of gauge and gravitational anomalies are reviewed. The impact of these anomalies on the construction, consistency, and application of the new superstring theories will be discussed. DOE

N86-32384# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
STUDY BY SYNCHROTRON RADIATION OF THE SUPERSTRUCTURE OF TETRATAENITE FROM THE SAINT-SEVERIN METEORITE
T. Tagai, H. Takeda, M. Tokinami, and J. Danon 1985 3 p
(DE86-701971; CBPF-NF-059/85) Avail: NTIS (US Sales Only) HC A02/MF A01

Tetrataenite is one of the FeNi minerals which is found in meteorite. The ordering state of Fe/Ni atoms in tetrataenite is determined, because it is closely connected with the thermal history of meteorites. DOE

N86-32385# Tuebingen Univ. (West Germany). Astronomisches Inst.
RESONANCE SCATTERING OF SOLAR RADIATION BY THE INTERPLANETARY MEDIUM Final Report, Dec. 1980
Carsten Wulf-Mathies Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 130 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-032; ISSN-0170-1339; ESA-86-97473) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27.50

The interplanetary resonance radiation of neutral hydrogen and helium at 121.6 nm and 58.4 nm was observed to analyze the temperature and the density of the interstellar medium in the vicinity of the Sun. The interstellar wind theory and solar line emissions are presented. The thermal effects on H density and He density are analyzed. The profile of the 58.4 nm line is calculated to determine the radiation distribution. The complete frequency redistribution is a good approximation of the resonance scattering process. The total intensity of the 58.4 nm line is calculated by a fourfold integration of a function including velocity distribution, frequency redistribution, and line shape. Results show differences < 10% between calculations and the approximate method. The method is sufficient to evaluate the 58.4 nm background measurements. ESA

N86-32349*# California Univ., San Diego. Dept. of Chemistry.
NUCLIDE PRODUCTION IN (VERY) SMALL METEORITES
James R. Arnold and Kunihiko Nishiizumi *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32354*# Physical Research Lab., Ahmedabad (India).
EVOLUTION OF GAS-RICH METEORITES: CLUES FROM COSMOGENIC NUCLIDES
J. N. Goswami *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32355*# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
THE EXPOSURE HISTORY OF JILIN AND PRODUCTION RATES OF COSMOGENIC NUCLIDES
G. Heusser *In* Lunar and Planetary Inst. Workshop on cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32356*# Arizona Univ., Tucson. NSF Accelerator Facility for Radioisotope Analysis
RADIONUCLIDE MEASUREMENTS BY ACCELERATOR MASS SPECTROMETRY AT ARIZONA
A. J. T. Jull, D. J. Donahue, and T. H. Zabel *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32360*# Cologne Univ. (West Germany). Inst. for Kernchemie.
PRODUCTION OF RADIONUCLIDES IN ARTIFICIAL METEORITES IRRADIATED ISOTROPICALLY WITH 600 MeV PROTONS
R. Michel, P. Dragovitsch, P. Englert, and U. Herpers *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 4 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32362*# California Univ., San Diego. Dept. of Chemistry.
COMPILATION OF COSMOGENIC RADIONUCLIDES IN METEORITES
Kunihiko Nishiizumi *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32363*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REDETERMINATION OF PARAMETERS FOR SEMI-EMPIRICAL MODEL FOR SPALLOGENIC He AND Ne IN CHONDRITES
L. E. Nyquist and A. F. McDowell (Lunar and Planetary Inst., Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32365*# Rutgers Univ., New Brunswick, N. J. Dept. of Chemistry.
THE 10Be CONTENTS OF SNC METEORITES
D. K. Pal, C. Tuniz (Istituto Nazionale di Fisica Nucleare, Trieste (Italy).), R. K. Moniot (Fordham Univ., New York, N.Y.), W. Savin (New Jersey Inst. of Tech., Newark.), S. Vajda, T. Kruse, and G. F. Herzog *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32366*# Cologne Univ. (West Germany). Inst. fuer Kernchemie.
STUDIES ON COSMOGENIC NUCLIDES IN METEORITES WITH REGARD TO AN APPLICATION AS POTENTIAL DEPTH INDICATORS
R. Sarafin, U. Herpers, P. Englert, R. Wieler (Eidgenoessische Technische Hochschule, Zurich (Switzerland).), P. Signer, G. Bonani, H. J. Hofmann, E. Morenzoni, M. Nessi, M. Suter et al *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32367*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
THE PRODUCTION RATE OF COSMOGENIC 21-Ne IN CHONDRITES DEDUCED FROM 81-Kr MEASUREMENTS
L. Schultz and M. Freundel *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32368*# Arizona Univ., Tucson. Dept. of Planetary Sciences.
A DIRECT TIME SERIES COMPARISON BETWEEN THE LA JOLLA AND BELFAST RADIOCARBON RECORDS
C. P. Sonett and H. E. Suess (California Univ., San Diego.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32369*# York Coll., Jamaica, N. Y.
NEUTRON CAPTURE PRODUCTION RATES OF COSMOGENIC 60Co, 59NI AND 36Cl IN STONY METEORITES
M. S. Spergel, R. C. Reedy (Los Alamos National Lab., N. Mex.), O. W. Lazareth (Brookhaven National Lab., Upton, N. Y.), and P. W. Levy *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32371*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
COSMOGENIC RARE GASES AND 10-Be IN A CROSS SECTION OF KNYAHINYA
R. Wieler, P. Signer, U. Herpers (Cologne Univ. (West Germany).), R. Sarafin, G. Bonani, H. J. Hofmann, E. Morenzoni, M. Nessi, M. Suter, and W. Woelfli *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 1 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N86-32386*# Arizona Univ., Tucson. Lunar and Planetary Lab.
INTERIORS OF THE GIANT PLANETS Semiannual Report, 1 Oct. 1985 - 1 Apr. 1986
W. B. Hubbard 18 Sep. 1986 7 p
(Grant NsG-7045)
(NASA-CR-177154; NAS 1.26:177154; SAR-24) Avail: NTIS HC A02/MF A01 CSCL 03B

The Neptune central flash data obtained from the August 20, 1985 occultation was analyzed. The three main objectives of the analysis, which combined the study of the CTIO data with the ESO data obtained by the Meudon groups were: deduce the oblateness, equatorial radius, and pole positon angle of Neptune from a combined analysis of the limb-occultation and central-flash data; determine the temperature/absorption profile in Neptune's atmosphere in the region probed by the occultation data (from 1 microbar to about 0.2 mbar), as well as atmospheric distortions produced by waves or turbulence; and search for additional Neptune ring arcs. Results were discussed in terms of the three main objectives. B.G.

N86-32387# Michigan Univ., Ann Arbor. Dept. of Physics.
A SENSITIVE RADAR SEARCH FOR SMALL NATURAL SATELLITES OF THE EARTH Final Report, 15 May 1983 - 14 Jul. 1985
Michael J. Longo 30 Sep. 1985 17 p
(Grant AF-AFOSR-0128-83)
(AD-A167777; AFOSR-86-0238TR) Avail: NTIS HC A02/MF A01 CSCL 03/3

We have used radar tracking data from NORAD to perform a sensitive search for small natural satellites of the Earth. This search would be sensitive to satellites ranging from 5 cm in diameter with perigee heights 400 km to about 40 cm with perigees 10000 km. While a few unidentified objects were found, these were all near transfer orbits likely to contain debris from satellite launches. No objects that are unlikely to be manmade were seen. GRA

N86-32388# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
SOLID STATE TRANSFORMATIONS IN Fe-NI ALLOYS FROM METEORITES IN POWDER FORM
R. B. Scorzelli, J. Danon, and E. G. da Silva 1985 14 p Prepared in cooperation with Minas Gerais Univ., Belo Horizonte, Brazil
(DE86-701936; CBPF-NF-066/85) Avail: NTIS (US Sales Only) HC A02/MF A01

Moessbauer studies by transmission and back-scattering techniques with Cape York and Santa Catharina meteorites in powder form are reported. Martensitic transformation from gamma-phase to alpha-phase is induced by mechanical treatment and long-range order is affected. DOE

N86-32350*# Max-Planck-Inst. fuer Chemie, Mainz (West Germany).
SIMULATION EXPERIMENTS FOR GAMMA-RAY MAPPING OF PLANETARY SURFACES: SCATTERING OF HIGH-ENERGY NEUTRONS
J. Brueckner, P. Englert (Cologne Univ. (West Germany).), R. C. Reedy (Los Alamos National Lab., N. Mex.), and H. Waenke *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-32351*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
PRECOMPACTION IRRADIATION EFFECTS: PARTICLES FROM AN EARLY ACTIVE SUN?
M. W. Caffee, J. N. Goswami (Physical Research Lab., Ahmedabad (India).), C. M. Hohenberg, and T. D. Swindle *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32353*# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
SOLAR MODULATION OF GALACTIC COSMIC RAYS: CONTEMPORARY OBSERVATIONS AND THEORIES
M. A. Forman *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 2 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-32357*# Scripps Institution of Oceanography, La Jolla, Calif. Geological Research Div.

COSMIC RAY INTERACTIONS IN THE GROUND: TEMPORAL VARIATIONS IN COSMIC RAY INTENSITIES AND GEOPHYSICAL STUDIES

D. Lal *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

N86-32370*# Cologne Univ. (West Germany). Inst. fuer Kernchemie.

SIMULATION OF COSMIC IRRADIATION CONDITIONS IN THICK TARGET ARRANGEMENTS

S. Theis, P. Englert, R. C. Reedy (Los Alamos National Lab., N. Mex.), and J. R. Arnold (California Univ., San Diego.) *In* Lunar and Planetary Inst. Workshop on Cosmogenic Nuclides 1986 3 p (For primary document see N86-32348 23-88)
Avail: NTIS HC A05/MF A01 CSCL 03B

99 GENERAL

No abstracts in this category.